

The AMSAT[®] Journal

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CQ CQ Deutsche



Astronaut Bonnie J. Dunbar, STS-71 mission specialist, floats about in the science module of Spacelab as astronaut Norman E. Thagard looks on. Thagard had completed four months in space aboard Russia's Mir Space Station. (NASA)

Three and a Half Months of Amateur Radio Aboard Mir

by Philip Chien, KC4YER, kc4yer@amsat.org

Astronaut Norm Thagard recently spent three and a half months aboard the Russian space station Mir. It was an incredible experience for him, and a major step forward for the joint U.S. and Russian space activities. Writer Philip Chien, KC4YER, interviewed Dr. Thagard for a science column which will be appearing in the November issue of *Popular Mechanics*. In addition he spent much of the interview discussing Norm's amateur radio activities aboard Mir as ROMIR.

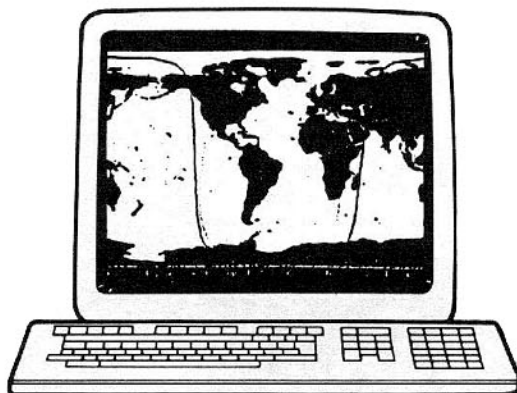
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by Bill Tynan W3XO

We ARE Listening!

During August, nearly 800 of our members, whose names were selected at random, were mailed a short (6 question) survey. This survey was designed to gather information on our member's current operating activity and solicit inputs regarding the types of satellite projects they think should be pursued once Phase 3D is built and successfully launched. This survey is but one of the ways in which we, who AMSAT-NA members have chosen to guide the organization, are endeavoring to ascertain our members' opinions. Yes: We ARE listening!

I hope that everyone who received the survey responded to it. This is particularly important because the survey had to be sent only to a limited number of members. Sending questionnaires to the entire 7,500 AMSAT-NA membership would have been financially prohibitive and would have required a much greater amount of time to evaluate than the limited sample employed. It was concluded that a sample, drawn randomly from the AMSAT-NA membership database, would provide a good indication of our members' opinions. The sample size used, somewhat more than 10 per cent of the total AMSAT-NA membership, represents a far larger percentage of the total population than do the TV rating surveys or political polls, on which so much is based.

The results of our survey will be presented at this year's AMSAT-NA Board of Directors meeting to be held in conjunction with AMSAT's 1995 Space Symposium in Orlando October 6 through 8. The Board will make use of these data then, and at future meetings, to help chart the organization's course in the years to come. If you were not one of those who received a survey form, please do not feel left out. You can always write to us at PO Box 27 Washington, DC 20044 and express your thoughts. Of course, that does not mean that all suggestions can be carried out. Some proposals for future projects received to date are simply not practical from the

standpoint of what a non-government, non-commercial, volunteer based organization can successfully accomplish. Other suggestions are simply not feasible due to established U.S. and international regulations and frequency allocations. Such regulations and allocations are extremely difficult, and sometimes impossible, to change. Still other suggestions may not be feasible from a technical standpoint. But believe me, all letters are read and evaluated.

Naturally, the suggestions which have the best chance of leading somewhere are those backed up by a commitment to help carry them out. As has been said previously, "AMSAT is all of us." A prime example of this is a young man who showed up at last year's Space Symposium and presented a concrete proposal to build a wide band spread spectrum transponder. He is now in the process of constructing such a unit, and plans to demonstrate it on flights aboard a small plane. This is a very sound approach. The viability of the types of transponders, which have been used in amateur satellites since OSCAR 6, were first demonstrated with balloon and aircraft flights.

As I have maintained in these editorials previously, the thoughts and opinions of our members have always very important to us. Information gathered via the survey, as well as other correspondence, is a big help to the AMSAT-NA leadership as we make plans to move beyond Phase 3D and into the next century. But most useful, are commitments from those willing to take on the projects that they and others propose. Finding the "new blood" to carry on AMSAT-NA's technical and administrative functions is becoming an increasingly critical factor; one which, if not filled, could significantly limit our future activities.

To all of you who took the time to complete and return their surveys, as well as those who have and will offer their thoughts via other means, I want to express my personal thanks for your cooperation and assistance in helping shape the future of AMSAT-NA and the entire amateur space program. ■



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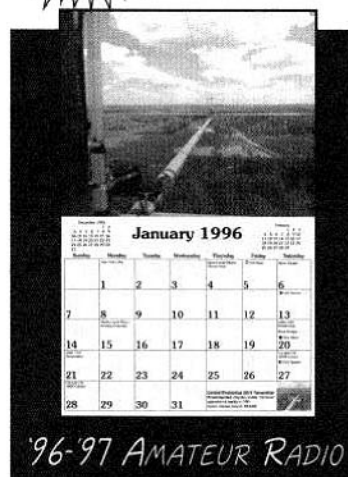
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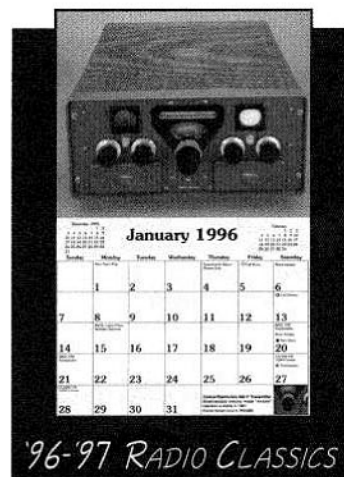
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[THAGARD, Continued from pg. 1]

Dr. Thagard was one of the first astronauts chosen specifically for the shuttle program, back in 1978. His experience before becoming an astronaut included a tour of duty as a Marine fighter pilot in Vietnam, a medical doctorate, and a doctorate of electrical engineering. His first space flight was the STS-7 mission in June 1983 aboard Challenger. He had been added to the crew fairly late into the training process specifically to investigate space sickness which affects many astronauts. Dr. Thagard's second spaceflight in April 1985 aboard the STS 51-B Spacelab 3 mission included a week of microgravity and life science experiments. For that mission he had dual responsibilities - he was flight engineer during the launch and entry, and a scientist during the mission. Dr. Thagard's third spaceflight was the STS-30 mission in May 1989 which launched the highly successful Magellan spacecraft to Venus. His fourth spaceflight was the eight day International Microgravity Laboratory mission aboard STS-42 in January 1992 where an international crew spent eight days performing microgravity experiments. In April 1993 Thagard traveled to Russia as part of a preliminary group of scientists, engineers, and managers to evaluate the facilities at the formerly top secret Star City near Moscow where Russian cosmonauts train. In early 1994 it was announced that Norm Thagard would be the first American astronaut to fly to Mir, along with Russian cosmonauts Vladimir Dezhurov and Gennady Strekalov.

On March 14, 1995 Thagard and his two companions were launched into space aboard a Soyuz vehicle from the former Soviet republic of Kazakhstan. There are no plans to have any other Americans launch aboard a Soyuz rocket; future American astronauts who visit Mir will travel to and from Mir on the shuttle. What's especially unique about Thagard's visit is that the Mir 18 crew became the only space travelers to return from space aboard a completely different type of vehicle from the one on which they launched. On June 29, 1995 the shuttle Atlantis docked with the Mir complex. The docked vehicles set a new record for an artificial object in space - with a mass of over 220 tons. Over 250 items were transferred from the shuttle to Mir, and 200 items from Mir to the shuttle. Thagard and his two companions returned to Earth aboard the shuttle Atlantis. The following is an interview between the author (in *italics*) and Thagard:

KC4YER: I understand that during the early portion of your mission you only received Russian news, no U.S. news?

The Russians send up Russian news every day or two. I understood a lot of it, but not all of it, obviously. And it's going to be more of interest to Russians because it's more oriented towards events which are important to Russia. I hadn't thought much about it but during one of my interviews I was asked whether or not I was getting news and I said no. A week after that I started getting news from the Johnson Space Center personnel in the Russian Mission Control center, but I got regular news from Dave Larson, N6JLH, via the ham radio setup very soon after that reporter asked the question. I started getting a lot of offers from hams to send news up to Mir. We worked out a deal where Dave sent me up news practically on a daily basis via packet. All three of us looked at that a little bit, I guess me most of all because I could read the English a little bit faster. That's a nice feature and I'm glad we have that on-board and I'm certain it'll be used by future folks who are up

there. For future flights we probably ought to send up news on a more formal basis rather than the ham radio setup.

The lack of news wasn't something I was complaining about, but I was asked the question by the interviewer and I wasn't going to lie. The fact is till that point the only news that was coming up was the Russian news.

KC4YER: I heard you on the ham radio talking with astronaut Jay Apt, N5QWL, about doing earth observations for the scientists at the Johnson Space Center. Any luck?

Jay would pass on the Earth obs sites to Dave Larson and he would send them up to me via packet, and that seemed to work pretty well. Even before I was getting Earth obs information I was doing some videos and photos of areas of interest to me for whatever reason.

KC4YER: I heard you on the radio many times calling for Tallahassee where you went to school, and kind of surprised that you couldn't get anybody to return your call.

Never, never got anybody from Tallahassee to answer. It would have been nice, but I got to talk to a lot of folks. The ham radio's a nice thing to have.



Astronaut Norman E. Thagard in a cosmonaut space suit at the Gagarin Cosmonaut Training Center (Star City), near Moscow, Russia. (NASA)

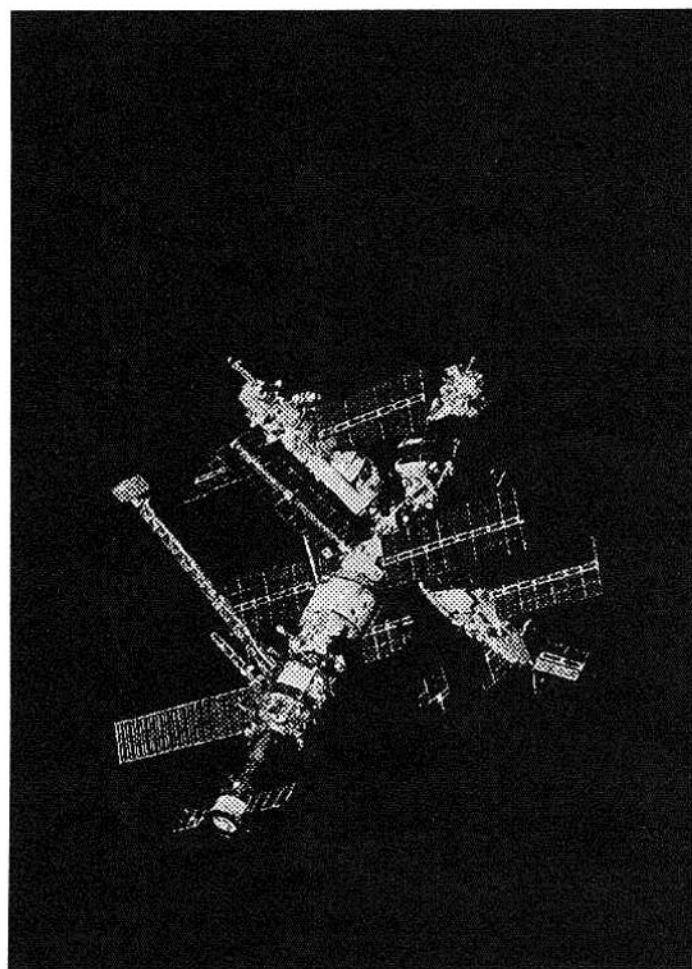
A number of folks called and said "I'm not from Tallahassee but I can relay," and I was thinking I know you can relay but I still want to talk to Tallahassee. I just didn't answer those calls.

I never took a count of how many people I talked to via ham radio but it was several hundred. I'm looking at a whole box of QSL cards that need to be answered. I kept a log, but it turns out that we have somebody here at JSC that normally acknowledges ham radio contacts [Dale Martin]. My plan is to just turn over these cards and let our system reply to them.

[Authors note: QSL cards should be sent to W5RRR c/o Johnson Space Center, Houston Texas 77058. Include a SASE if you want a reply. W5RRR, the Johnson Space Center amateur radio club station, is planning on making a joint Mir 18/STS-71/Mir 19 QSL card for the combined missions.]

KC4YER: I heard that you used to be an amateur radio operator?

When I was 14 years old I got my ham license. I was K4YSY growing up in Jacksonville Florida. In those days you had to have so many hours of operation before your license was up for renewal. In 1969 when my license was up for renewal I was in Vietnam so obviously I had no opportunity to maintain my licensing requirements.



Russia's Mir Space Station, taken from the Space Shuttle Atlantis. (NASA)

KC4YER: Was there any thought about you getting a U.S. license and call while training for your Mir mission?

There was, but I honestly didn't want to spend the time. I wanted to spend the time that that would take on my Russian language training.

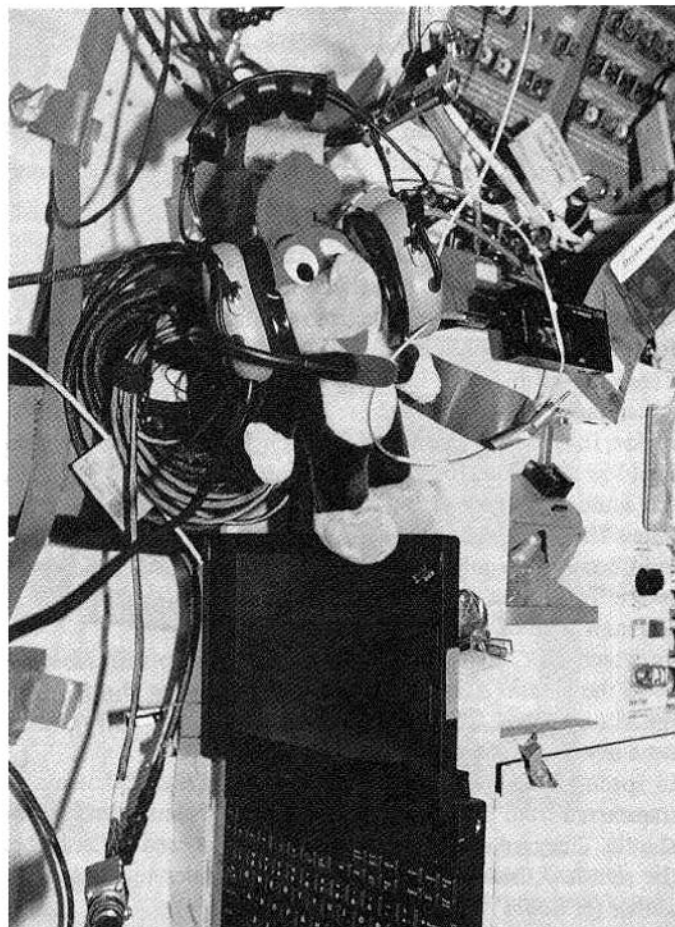
The cosmonauts encouraged me to use the radio on-board, and I was reluctant to do it without a U.S. license. But they kept reassuring me that everybody who comes aboard Mir is authorized by the Russian government to use the ham station.

When I got on-board I wasn't even sure about the legality of me talking over their ham radio. But they finally convinced me that it was all okay. They basically insisted that I use the ham radio and it was good to have that.

KC4YER: Did you ever feel the need to use the ham radio to talk to people around the world when you were feeling lonely?

Well I was never lonely. Not even once. Or sad or homesick. To relieve the boredom sometimes when I didn't have much to do I would pick up the ham set.

I kind of got discouraged a bit with the ham radio. I wanted to try to give as many people as possible the chance to make contact



Woody, WO5ODY, the sixth crew member aboard STS-70 mission explains why so many SAREX random QSOs were made on that mission. (NASA)

with ROMIR, because I've been on the other side trying to contact the exotic stations. But it seemed like a few folks with very powerful transmitters and beams wanted to contact me virtually every time I was in range, and of course that made it very difficult to talk to a lot of folks. Occasionally you do want to talk to somebody like Dave Larson out in California. We kind of struck up a relationship, and obviously W5RRR and the folks I know out here. But in general I really wanted to give as many people as possible the opportunity to talk to ROMIR. It was kind of discouraging that you'd try to do that, and you'd have these real strong stations who had talked to you any number of times step all over the conversations.

Sometimes in the wee small hours when I wouldn't hear anybody I thought here's the opportunity to get a chance to talk to a station which hasn't already talked to ROMIR before I would make a 'CQ' call.

My background was as a real ham, way back when, and I remember how frustrating it was to try to contact some of these exotic stations and have one or two stations kind of dominate stuff. I wanted to give as many people as possible a chance to talk to the Russian Mir station.

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WARG Plans UK Base Cyprus DXpedition

David Bowman, G0MRF informs us that in late October 1995, members of Whitton Amateur Radio Group (WARG), London, England will be departing for a DXpedition to the British Sovereign Bases on the Island of Cyprus. The DXpedition callsign used will be ZC4DX. The DXpedition will be active for a period of two weeks from October 24, 1995 to November 6, 1995.

The group will be participating in the multi-single category of the CQWW SSB Contest. Equipment will be available for frequencies from 1.8 MHz to 2.4 GHz. A fully equipped satellite station with AZ/EL rotators and computer tracking software will be operational on CW/SSB. Operations will be primarily via AO-13 and RS-15. The Sovereign base areas (ZC) are very rare on satellite and this will be the first use of Mode S from this location. This DXpedition coincides with an attitude change of AO-13 which will improve communications. The WARG DXpedition will use the following equipment:

- MODE A:** 144MHz - FT726R, Microwave Modules 100W amp. 2 x 9 element yagi.
29MHz - TS405S 1.8kHz & 500Hz filters. Dipole and 3 element yagi.
- MODE B:** 435MHz - FT726R, Communications Concepts 100W amp.
144MHz - As above with masthead GaAs FET pre-amp.
- MODE S:** Airwave Systems 2.4 GHz down converter. 0.8m ASTRA offset feed dish using 4 turn helix.

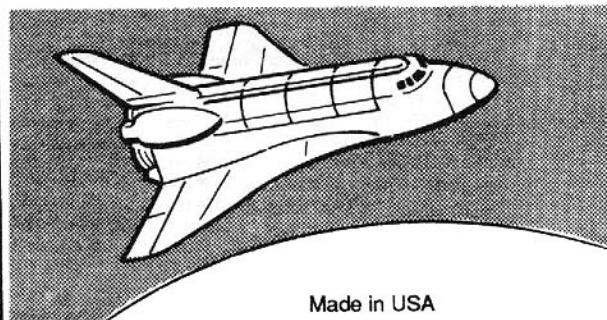
QSLs may be made to G0MRF direct or via bureau (international callbooks prior to 1994 list G0MRF under the call G8PDW). Further information about this DXpedition can be requested from G0MRF via e-mail: dx@vasek.demon.co.uk.

I had one ham radio contact with my wife; after the docked phase while I was on the shuttle via a ham in Australia (Graham Ratcliff, VK5AGR). It worked beautifully. That was a bit superior to the on-board Mir communications system in that there was no time delay. Usually in communications through Mir's on-board system there's enough of a time delay due to the satellite links so you have to make a conscious effort not to step on each other during conversations, but I thought it generally worked out all right for family contacts. On Mir they generally tend to schedule family contacts for once a week.

I would like to emphasize that the comment I made about 'cultural isolation' was not a complaint, it was just an observation. It is not a problem because of things like the ham radio, if you want to speak English you can always do that, it does give you access literally on a 24 hour basis with almost any place in the world which you would like to communicate with.

Four more U.S. astronauts are in training for future Mir missions. Shannon Lucid, John Blaha, Jerry Linenger, and Scott Parazynski are at "Star City" learning Russian and Mir's systems. It seems likely that, based on Norm's recommendations, the other U.S. astronauts will spend time aboard Mir operating its Amateur Radio station. Jerry already holds amateur license KC5HBR and it's possible that the others may choose to get U.S. licenses before they fly. Shannon is scheduled to be launched on the STS-76 shuttle flight in March 1996 for a five month stay aboard Mir.

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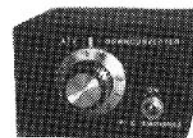
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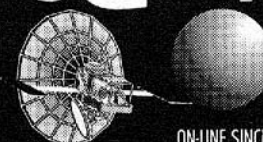
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Shuttle Antenna Testing

Lou McFadin, W5DID

Internet: w5did@amsat.org

For the seven Shuttle-Mir flights, NASA is using a Motorola URC-200 radio to communicate with Mir. The window-mounted antenna is based on the SAREX window 1/6 antenna which was first used in 1990 on the STS-35 mission. The URC-200 radio can transmit from 115-173.985 MHz and 225 to 399.9875 MHz, including the two-meter ham band. For Mir communications, the shuttle transmits on 121.5 MHz and receives on 130.1625 MHz, the same frequencies as the Soyuz spacecraft. The SAREX-M configuration uses the URC-200 radio tuned to our frequencies - resulting in an allotted payload weight of exactly zero pounds!

For the STS-71 mission the SAREX team and NASA wanted to characterize the new window antenna's characteristics. Its cavity is tuned for 121.5 MHz, well outside the ham band. It has a predicted SWR of 2:1 in the ham band, but we wanted to test it under actual conditions. The SAREX team put in a request to the space shuttle program office for permission to do the test. NASA agreed that data on the antenna's performance would be useful information for their purposes also. The Flight Activities Officer (FAO) reserved two times in the mission's timeline where Atlantis would pass over the Phase 3D Lab after the busiest portions of the mission were completed and Atlantis had undocked from Mir.

By March 1995 I had decided to retire from NASA after thirty years of working for the government and almost a decade as the SAREX principal investigator. Matt Bordelon, KC5BTL was willing to take over the position of SAREX principal investigator, although I'm not certain whether or not he knew how much of a task he was taking on. It turned out that the STS-71 and STS-70 SAREX mission were flown back-to-back, with Discovery's STS-70 launch coming just six days after Atlantis's landing completed the STS-71 mission. Matt did an excellent job for his 'baptism of fire' and has even made the decision to support five SAREX flights next year.

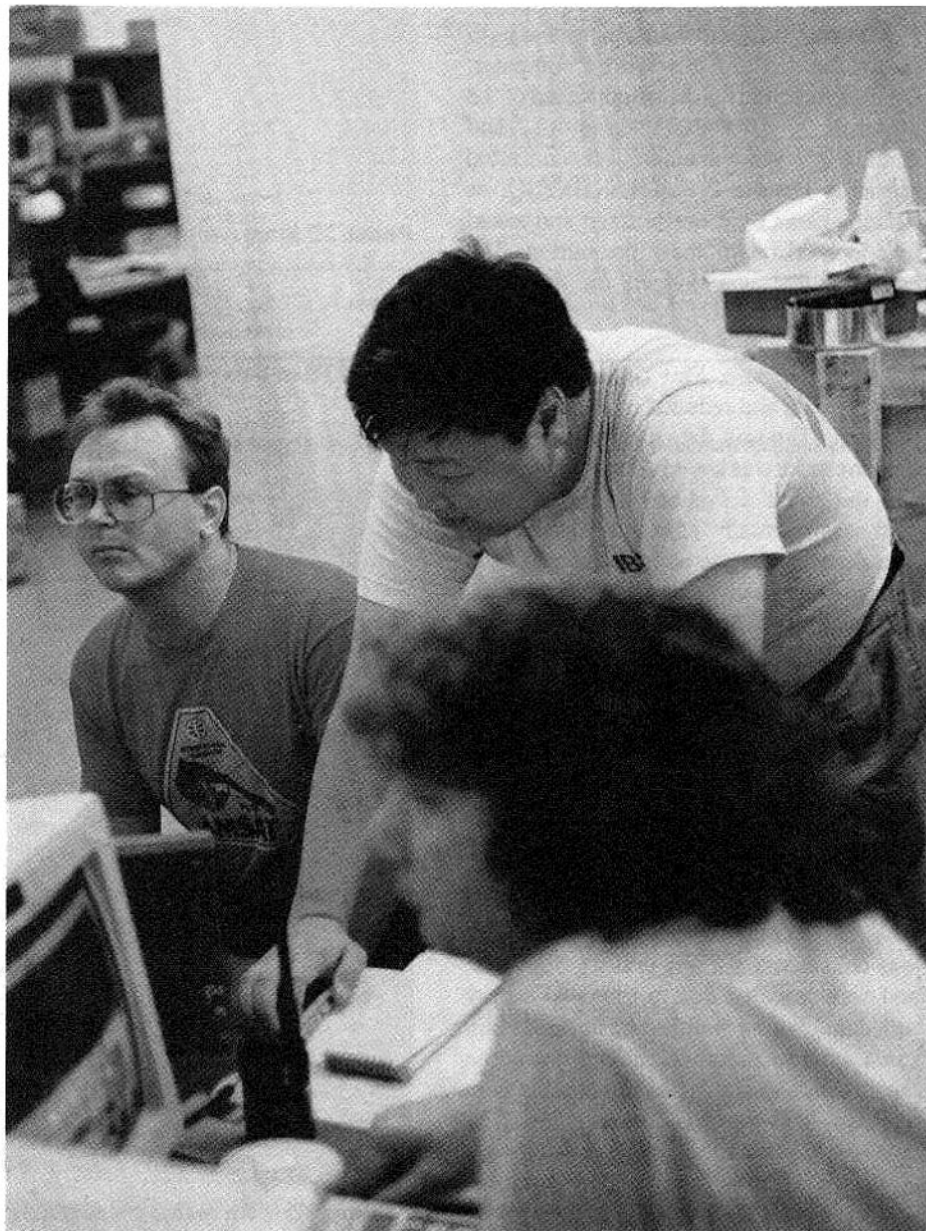
The Phase 3D integration team in Orlando Florida agreed to help perform the test and reduce the data. Chuck Hennessey, W4AT; Stan Wood, WA4NFY; and George Presley K4RSV, built two 5 element Yagi antennas, tuned to the Mir frequencies. George built a diode matrix to convert the Mir frequencies into the ham band. I asked Kai Siwiak, KE4PT to evaluate these data, since he had done a similar test for us on the STS-55 mission.

The test was scheduled for July 4th at 1:24 pm EDT, 6 days 21 hours 51 minutes into the STS-71 mission. At this point the shuttle had accomplished its primary mission - docking with the Mir space station. Atlantis undocked with Mir the

previous day and the crew was performing medical experiments and preparing for the trip home.

Ironically I couldn't participate in the test myself. By this point I had accepted an offer from AMSAT to become the Phase 3D spacecraft integration manager and had planned on participating in Florida. But it turned out that I had to be in Germany for a Phase 3D planning meeting. I wasn't worried about the test, since there were excellent people coordinating the test in both Houston and Florida.

As usual the SAREX team at the Johnson Space Center monitored the test and provided technical assistance. Gil



Roger Ream WB4SWZ, Philip Chien KC4YER, and Mike Peacock AD4OR monitor the SAREX antenna test during the STS-71 mission. (Photo Jeff Zerr)

Carman, WA5NOM calculated fresh Keplerian elements which ensured an accurate track of the shuttle's path across the sky. John Nickel, WD5EEV coordinated the test with NASA's flight control team. Volunteers at the Phase 3D lab in Orlando, Florida included Stan Wood, WA4NFY; Mike Peacock, AD4OR; Philip Chien, KC4YER; Roger Ream, WB4SWZ; Angie Ream, KE4RXJ; John Ellis, N5RAL; and Jeff Zerr, no call.

The hardware consisted of a fairly typical OSCAR setup - a KLM 22C two-meter Yagi antenna with computer-controlled azimuth/elevation, a Yaesu FT-736 transceiver, and a Mirage linear amplifier. Data recording equipment consisted of a chart recorder, and a National Instruments A/D card which permitted us to record the data directly with a computer. On the shuttle the hardware consisted of the Motorola URC-200 radio and window-mounted antenna. We contacted astronaut Charlie Precourt, KB5YSQ, as Atlantis came over our horizon and asked him to hold down the mike button. The carrier signal was logged on the chart recorders.

After the pass, Phil Chien, KC4YER took the data and reduced it to the graph in Figure 1. The raw data clearly show each time the mike was keyed aboard the shuttle, and the slight deviations as the Doppler shift was manually adjusted. These data also demonstrate the expected signal level changes due to the change in range as the shuttle passes over the ground test site. Kai Siwiak, KE4PT is processing these data to compensate for the shuttle's motion, range and changing angle with the ground station. He should be able to produce an antenna pattern showing that configuration's performance from these data.

Regrettably, we never did get to check out the external quadrafilar antenna mounted within Atlantis's cargo bay. It was considered a lower priority objective, and was canceled due to the crew's busy schedule. Future shuttle-Mir missions will use a window mounted antenna, based on the SAREX design to communicate with Mir, so it's possible the test could be rescheduled on a future mission.



Phase 3D team members used an Analog to Digital converter to collect data during the STS-71 antenna test. (Photo Jeff Zerr)



Phase 3D team members participate in a SAREX antenna test during the STS-71 mission. (clockwise from top): John Ellis N5RAL, Roger Ream WB4SWZ, Philip Chien, KC4YER, Mike Peacock AD4OR, Stan Wood WA4NFY, Angie Ream KE4RXJ. (Photo Jeff Zerr)

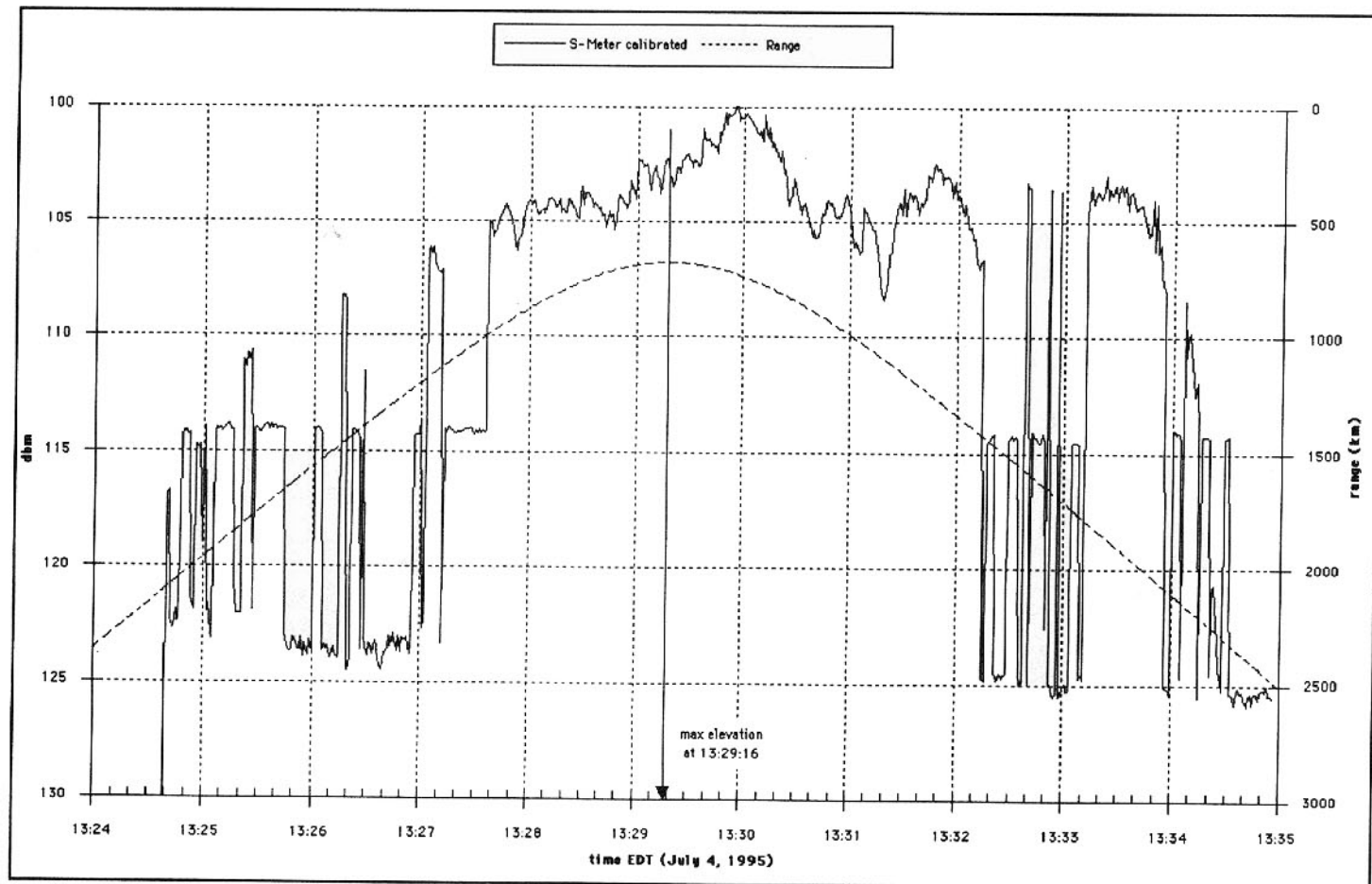
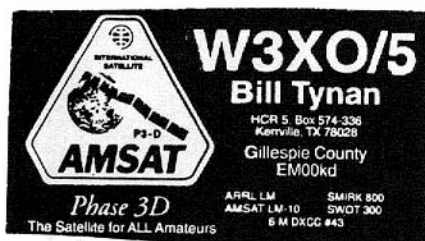


Figure 1. S-Meter calibrated to STS-71 range

Phase 3D QSLs

Show your support for Phase 3D every time you QSL!



Front

This confirms a QSO with _____
 on _____ at _____ Z
 _____, 19____.
 Your _____ signals were _____
 Rig _____ W to _____
 Ant. _____
 Thanks for the contact and 73.

Back

Cards are postcard size with red background and gold lettering. for name & call. Other lettering in white. Insert is light blue with dark blue lettering & AMSAT logo is red. Spacecraft is gold with purple solar panels. Earth is various shades of blue & white.

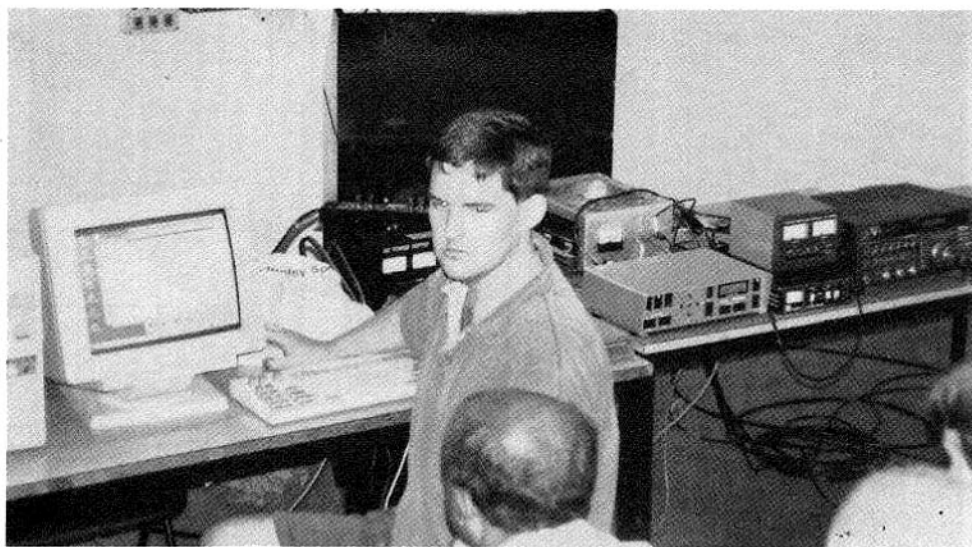
Please print your name & call as you want them to appear on the right front of your QSLs.

Name _____ Call _____ Address _____
 City _____ State/Province _____
 ZIP/Postal Code _____ Country _____ County (if desired) _____
 Other information, such as AMSAT #, ARRL, WAS, DXCC etc. (Six items only)
 1,000 cards \$150, plus \$5 US, \$12 Canada, \$20 other (Surface). Orders will be processed in batches of eight.
 Check, VISA/MC # _____ Exp. _____
 Daytime Phone: (____) _____ Signature _____

Tenth Annual AMSAT-UK Colloquium Held

The Tenth Annual AMSAT-UK Colloquium was recently held July 27-30 at the University of Surrey in Guildford, Surrey, England. The Colloquium had an international flare with over 113 participants attending the conference from five continents. Papers presented included:

- *A Low-Cost Microsatellite Ionosphere Topside Sounder* by David Palmer and Professor Martin Sweeting, OBE, G3YJO
- *A View of Eclipses on LEOs* by Vin Thompson, G4ULS
- *Communications Utilizing Low Earth Orbit Amateur Satellites from a High Latitude Site (Antarctica)* by Andre Phillips, VP8MAP
- *Experimental Datacasting by LEO Satellites* by Dr. Andras Gschwindt, HA5WH; Peter Bakki, HG5CQC; and Sandor Blasko, HG5CRS
- *Ka-Band Beacon Transponder for*

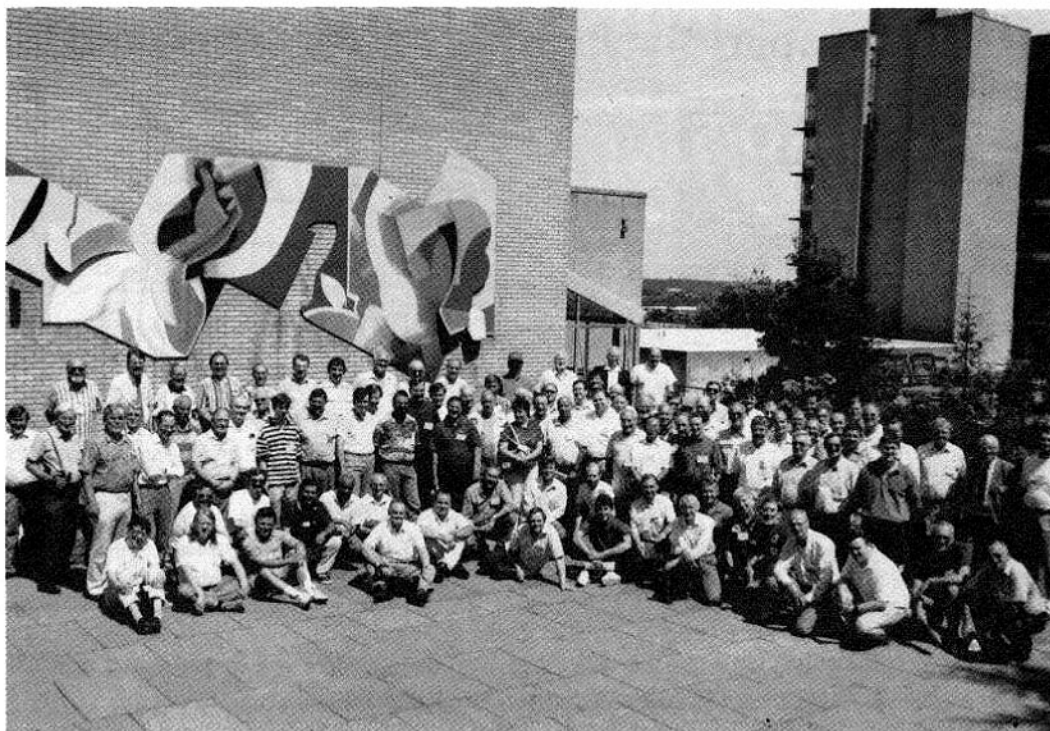


Chris Jackson, ZL2TPO/G7UPN demonstrating WISP (Photo by Ray Soifer, W2RS)

the AMSAT Phase 3D Satellite by Danny Orban, ON4AOD

- *A Short Information Paper for the Newcomer to the Hobby of Amateur Radio Satellites* by Ron Broadbent, MBE, G3AAJ

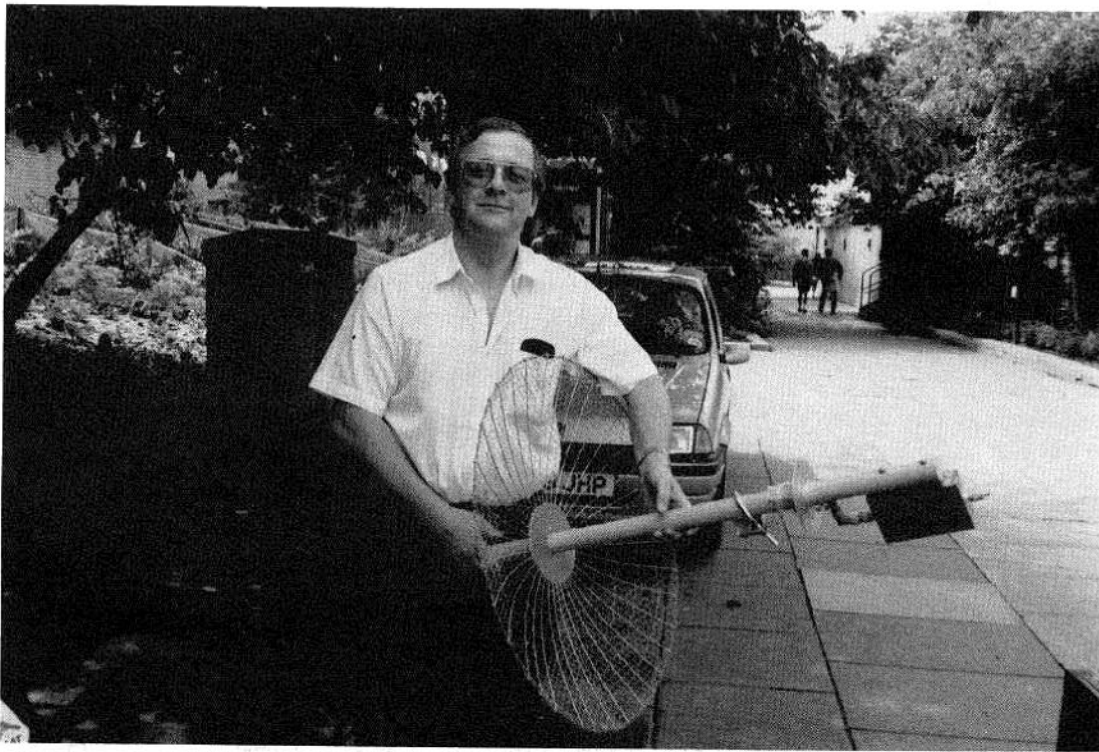
For information on obtaining a copy of the proceedings contact Ron Broadbent, MBE, G3AAJ, 94 Herongate Road, Wanstead Park, London, E12 5EQ, England. (e-mail: r.broadbent@ee.surrey.ac.uk)



Attendees of the Tenth AMSAT-UK Colloquium. (Photo by Ray Soifer, W2RS)

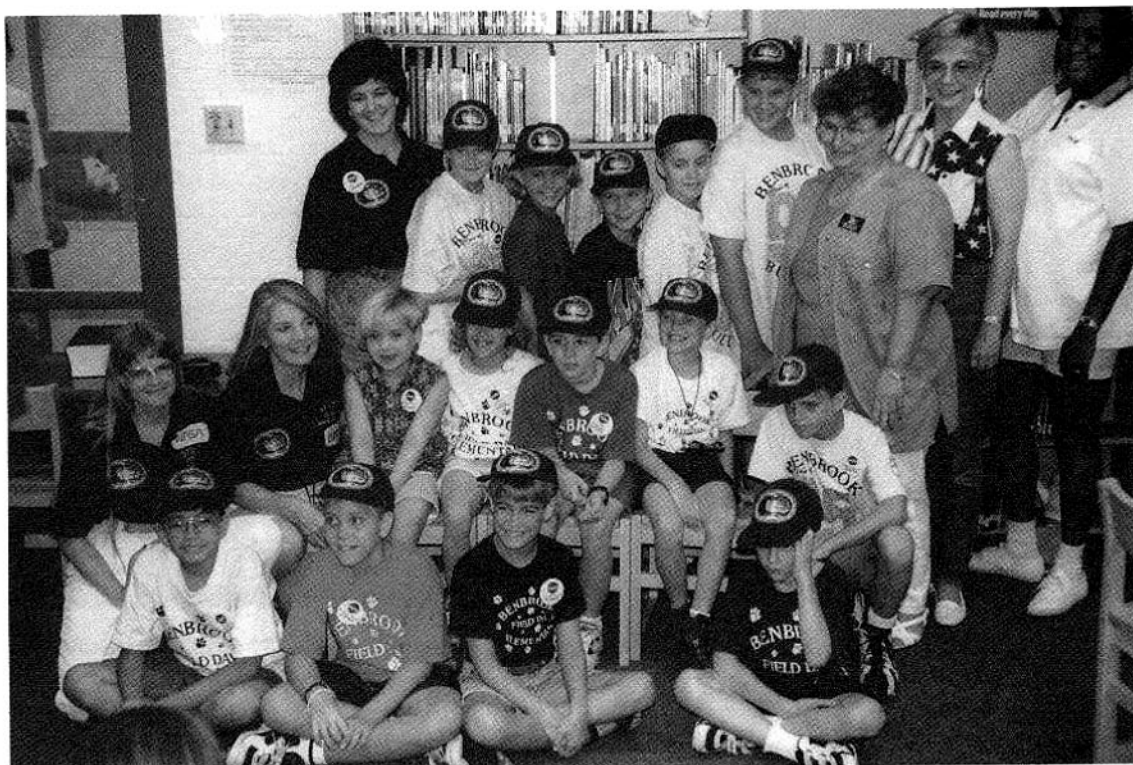


Geoff Perry, MBE, of the Kettering Group discovers a new Russian satellite (Photo by Ray Soifer, W2RS)



Richard Limebear, G3WRL, with his award-winning MODE S antenna (Photo by Ray Soifer, W2RS)

The Shuttle Amateur Radio Experiment at Benbrook Elementary



SAREX Teachers, Administrators, and Students: Front Row (l to r): Robert Rodriguez, Andrew Raley, David Inman, Matthew Jones. Middle Row (l to r): Donna McKinney, N5WOE, Jimmie Haygood, Shey Barton, Shantel Ferguson, Robert McKinney, Mark Keisling. Back Row (L to R): Penny Torres, Abby Kapavik, Jennifer Turner, Coy Barton, Mark Smith, Brandon Moore, Joy Lott, Jonna Murray, Kim Noel. (Photo Mike Rushing)

**by Randy, N5SVW and Donna,
N5WOE McKinney
73053.3502@compuserve.com**

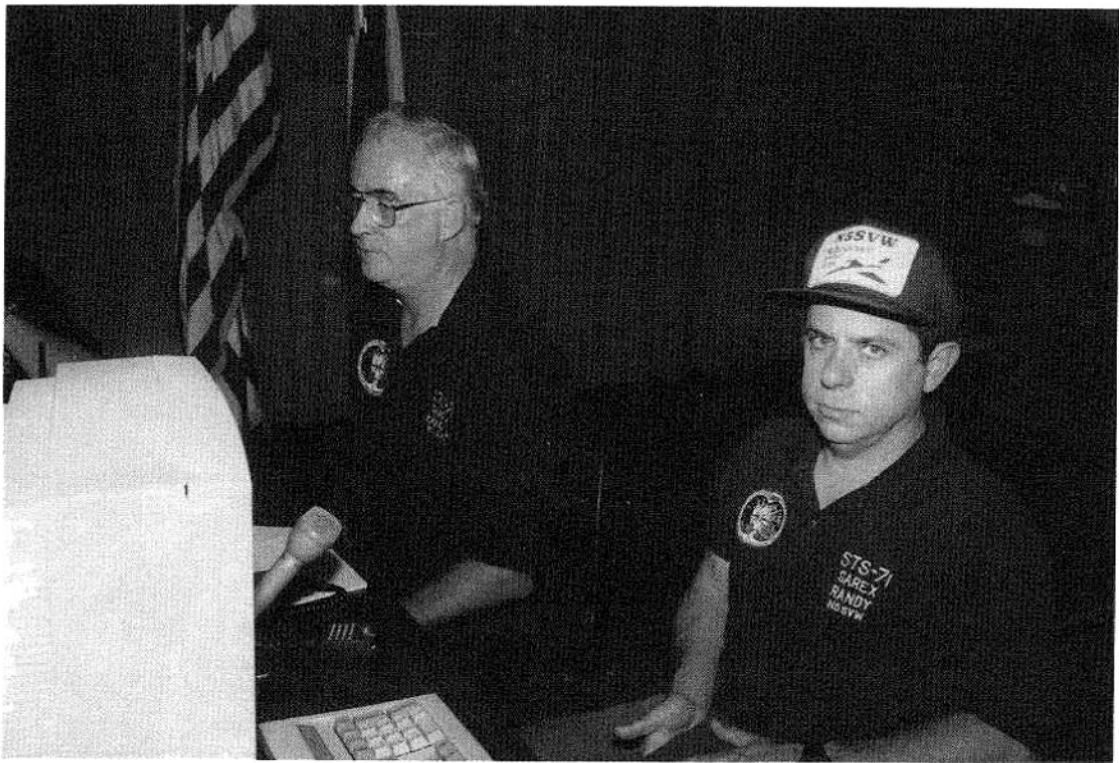
The students at Benbrook Elementary have had their minds directed toward space for two school years as part of the Shuttle Amateur Radio Experiment, or SAREX. Benbrook is a suburb located on the southwest side of Fort Worth, Texas, and home to many active Amateur Radio operators. Two parents at the school, Randy and Donna McKinney, introduced SAREX to the school in October 1993 after attending the 11th Annual AMSAT Space Symposium in Arlington, Texas. The McKinney's are active Amateur Radio operators and members of the Lockheed Martin Radio Club and the Metroplex AMSAT Information Group. These two groups helped support SAREX at Benbrook Elementary.

Many hours of educational activities for the 635 students led to a SAREX Radio contact with STS-71 on July 4th, 1995. These activities began with the formation of a Science Club, which featured guest speakers from the community, and the building and launching of model rockets. The Science Club also decorated the *Space Cafe* where every class came to eat lunch and enjoy a NASA video about life onboard a space shuttle. Other activities included a month long Space Camp, a telescope star party, and a visit by Astronaut Dr. Bernard Harris, Jr. (STS-63). A group picture of 680 people from the school and community was taken and flown into space on the Atlantis. It has been autographed by the STS-71 crew and will soon be returned to the school for display.

Students asked the Benbrook City Council to rename the street in front of the school *Astronaut Avenue* for the duration of

the STS-71 mission. The name was decided on by a school-wide *Student Contest* election. A contest was also held to design a logo for SAREX 1995 at Benbrook Elementary. This logo was used on 640 T-Shirts, invitations and thank you cards for the event. Another *Student Question* contest was held to decide which students would be awarded the once in a lifetime experience of talking to an astronaut in orbit via Amateur Radio.

Thousands of volunteer hours went into the project. The McKinney's coordinated the project with help from teachers and school administrators, who fit SAREX into their curriculum. Other school parents helped with many aspects of the project. People, organizations and businesses from the communities of Benbrook and Fort Worth supported SAREX through guest speakers, exhibits, and donations of educational materials. The local



Harold Reasoner, K5SXX with Randy McKinney, N5SVW, on July 4th just before SAREX contact
(Photo Mike Rushing)



Full station on the day of Benbrook Elementary's SAREX contact (July 4th). (Photo Mike Rushing)

newspapers gave much coverage to the project helping to publicize Amateur Radio and its part with SAREX to both communities.

The culmination of all of these activities took place on July 4th, 1995 when Benbrook Elementary was placed in the STS-71 timeline for a SAREX contact just before 2:00 pm CDT (2000 UTC). Benbrook Elementary was the first school scheduled for a SAREX school contact with the shuttle using the new Mir radio configuration of a Motorola Radio and Helix antenna in the cargo bay. All of the Amateur Radio operators involved were very anxious about the signal strength coming from Atlantis.

We started hearing Atlantis/Astronaut Greg Harbaugh about 1 1/2 minutes into the pass, but had to wait until almost 2 minutes to hear him over the local power line noise (which had never been there during any of our evening rehearsals). His signal was 5/9 during the middle of the pass. We were pleased at how well he heard our students. He did not ask for any of them to repeat! We had 11 questions answered and with only 3 students being disappointed in not having time to answer their questions.

There were about 250 people (mostly non-hams) present during the contact. They were spellbound by what they were witnessing. It was very rewarding for everyone, especially the 11 successful students.

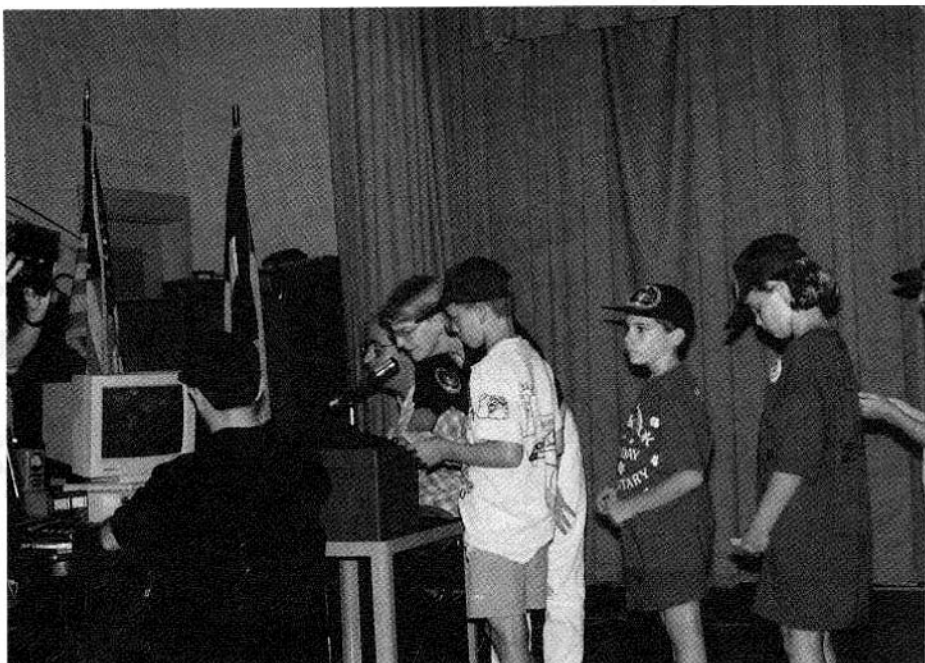
We had excellent media coverage for our SAREX radio contact with STS-71. The week before our event four local radio stations played interviews and announcements about the upcoming event. One local NBC station did a story on our dress rehearsal, which was on the day the Atlantis and Mir actually docked. On July 4th during our SAREX radio contact, the media showed up in force: three local television stations (NBC, CBS, and FOX), two local radio stations and four local newspapers. The coverage they gave us was great with every story mentioning both the Shuttle Amateur Radio Experiment and Amateur Radio's role in the project. This coverage reached throughout much of the state of Texas.

The SAREX contact was rebroadcast in real time over a system of repeaters covering much of North Texas. Many

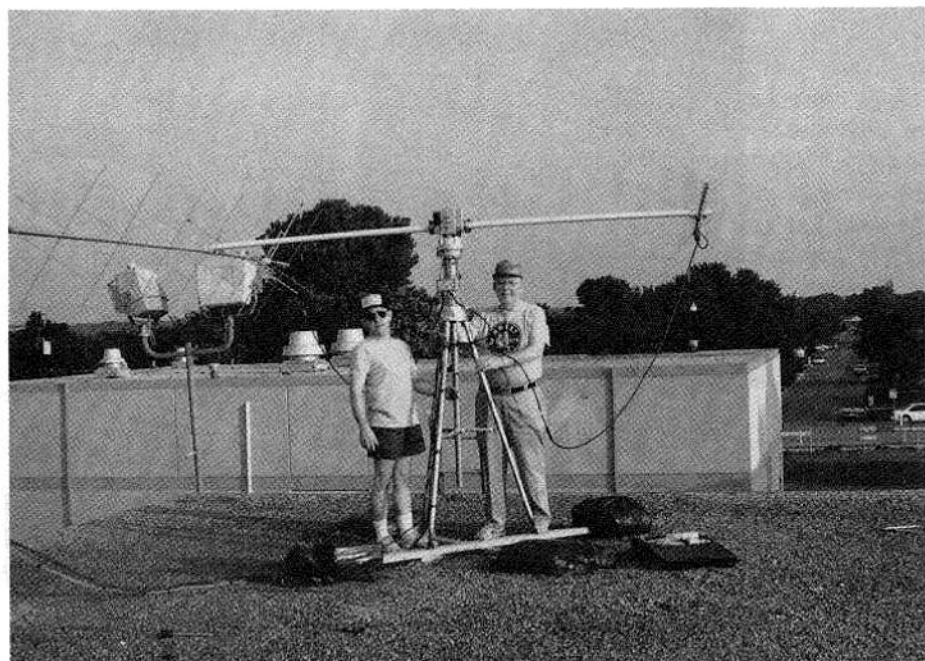
Amateur Radio operators who were not able to attend were still able to share in the experience in this way. Special thanks to Harold Reasoner, K5SXX, and Gary Higgs, N5XED for their help with this.

The Amateur Radio operators involved in the setup of the SAREX station were:

Randy McKinney, N5SVW, Donna McKinney, N5WOE, Keith Pugh, W5IU, Harold Reasoner, K5SXX, Mark Felton, N5UWM, Doug Howard, KG5OA, and Ralph Ward, KB5UAA. Many others assisted during the contact. Figure 1 provides a block diagram of the setup of the SAREX station at the school.



Randy McKinney, N5SVW, Harold Reasoner, K5SXX, Donna McKinney, N5WOE, Patrick Johnson, Robert McKinney, Jennifer Turner (Photo Claude Whitley, WB5FLQ)



Randy McKinney, N5SVW, with Keith Pugh, W5IU on roof at school. (Photo Donna McKinney, N5WOE)

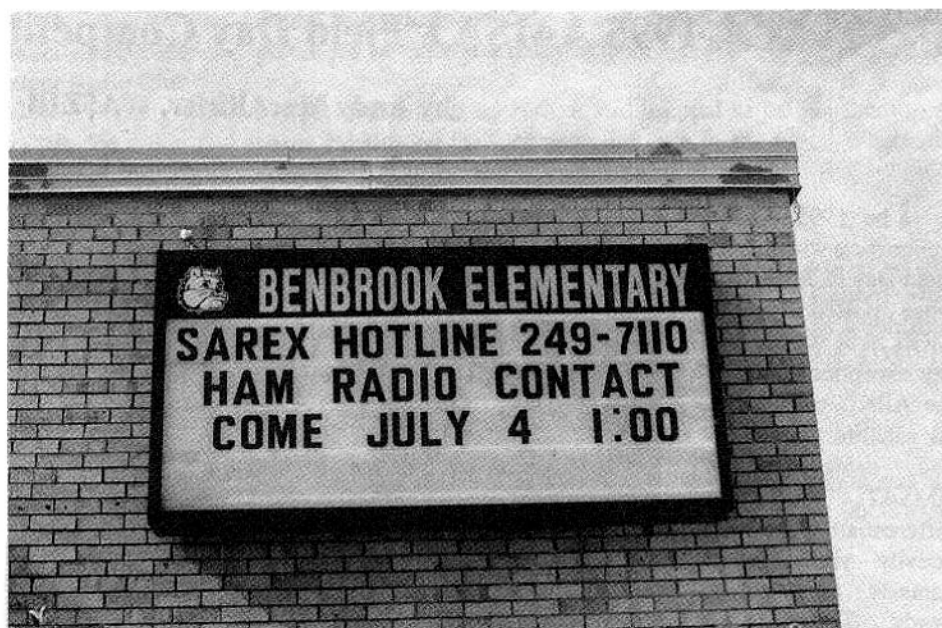
SAREX at Benbrook Elementary was a lot of work involving many, many hours. The project educated the students, school staff, and community about Amateur Radio and the space program. It emphasized the importance of education to reach future goals. We think we will see the rewards in the lives of many of the students at the school. Their hugs in the hallway are the real reward!

We wish to thank everyone in the SAREX Working Group and the crew of STS-71 for selecting our school to speak with them. We feel very honored to have been involved with STS-71 and its historic first docking with the Russian Mir space station. None of us will ever forget where we were on the 4th of July in 1995.

Randy and Donna McKinney are both active with AMSAT activities serving as Net Control Operators on the local Metroplex AMSAT Information Net. They also relay the signal of the weekly Houston Area

AMSAT Net via TVRO dish to a local repeater in the Ft. Worth area. They enjoy being involved with other aspects of Ham Radio including communications for public service events, SKYWARN Nets and

sharing "ham-time" with their sons Robert (age 10) and James (age 6). Randy and Donna are both R.A.C.E.S. members, and have been involved with the North Texas Balloon Project since its beginning in 1990.



Marquee at school (Photo Donna McKinney, N5WOE)

BENBROOK ELEMENTARY SCHOOL SAREX STATION CONFIGURATION

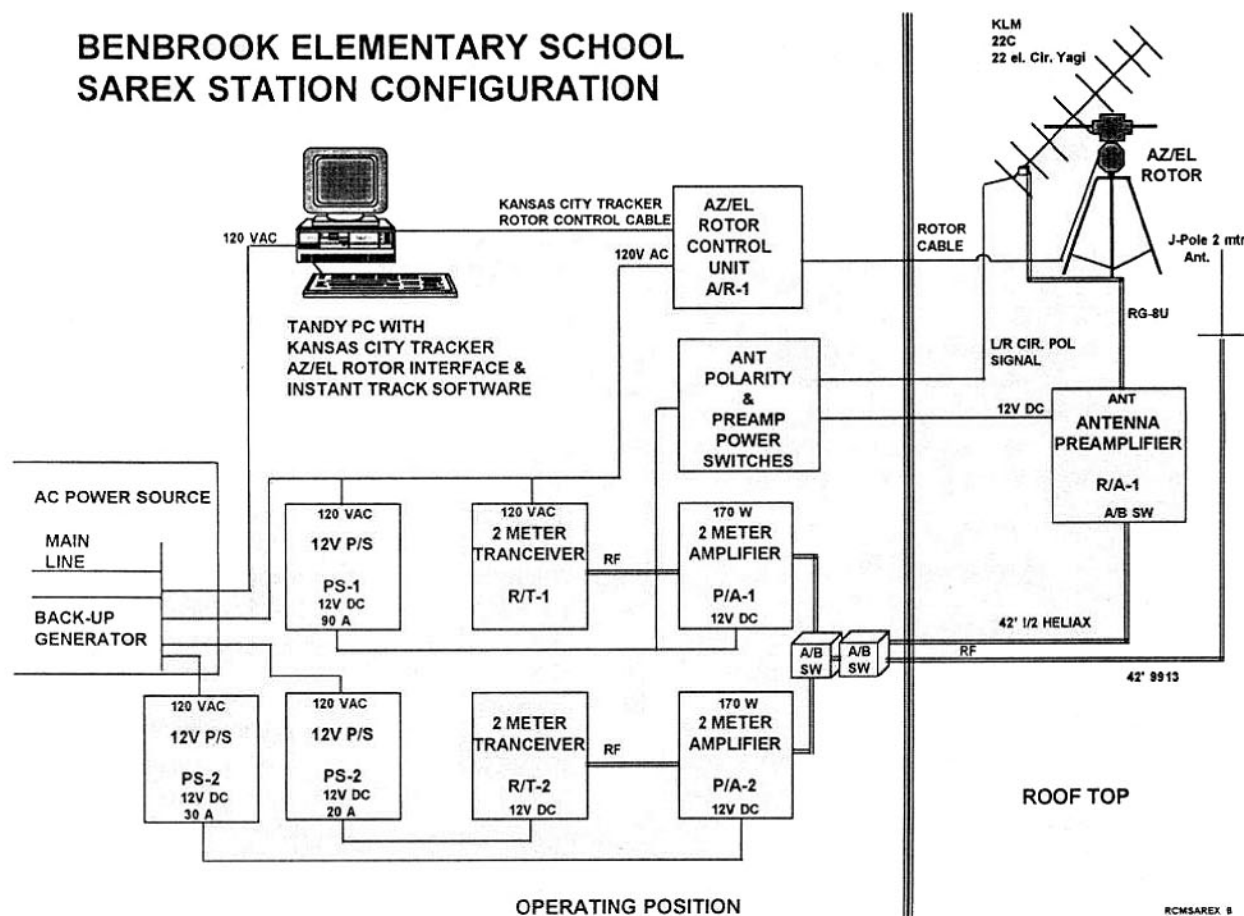


Figure 1.

1995 AMSAT Field Day Competition Results

by Andy MacAllister, WA5ZIB

The 1995 AMSAT Field Day Competition was held in conjunction with the yearly American Radio Relay League (ARRL) Field Day in June. Rules for the AMSAT activity were similar to those posted by the ARRL, but with a few key exceptions. While the ARRL rules lump all satellite activity in one category, the AMSAT rules differentiate between activity via different hamsats as separate bands. The AMSAT rules also provide bonus multipliers for digital satellite downloads and uploads of Field Day greeting messages.

The 1995 competition was very active. Every available amateur radio satellite had Field Day participants in pursuit of contacts. Several DX stations participated in the activity. DX stations are encouraged to participate in the AMSAT Field Day activity as equal participants.

Unlike last year, some problems were noted with loading on the low-orbit Mode-A satellites, but operation via AMSAT-OSCAR-10 and AMSAT-OSCAR-13 was just typical Field Day. The entry sheet was easier to use this year and the rules were easily understood by most of the 35 stations that submitted entries.

Once again the Scottsdale Amateur Radio Club working with the Central Arizona DX Association came in first. Station operators included Bob Myers W1XT, Ned Stearns AA7A and Tom Boza WB7ASR. Separate positions were set up to track and operate different satellites. Significant emphasis was placed on the potentially lucrative digital satellite downloads. It was a remarkable performance. Running a close second was the group at WB6LLO. Dave and other members of the North Shore Amateur Radio Club pursued the digital satellites and over 100 analog contacts via AO-10, AO-13, FO-20, RS-10/11 and RS-15.

An example of the importance of digisat points was made by Kristi Smyth N8WSG. Operating only via AO-13 on CW and via the 9600-baud digital satellites, Kristi scored 199 points with only

two CW QSO's on AO-13, a Field Day message uplink to each digisat and 36 Field Day message downloads from the digisats.

Many thanks to all of you that operated in this years' event. It



Vince Fiscus, KB7HDL and Bernie Miller, N7DQV at K7EFA, Billings Montana Yellowstone Radioclub 1995 Field Day Station (Photo by Bob Rightmire, WA7YNU)

was a great opportunity to show other Field Day participants how easy and exciting satellites can be. It was also a chance for some competition on the birds and an occasion to test hamsat radio gear and antennas in emergency conditions.

Comments on this years' rules have been mixed. Most operators liked the new emphasis on digital satellite activity, but felt that the multiplier (x 5) was too high. Others asked for a separate QRP category, and some asked that multiple transmitters be allowed simultaneous activity on analog

transponders (one on CW and one on SSB). Changes are possible for the 1996 AMSAT Field Day event.

What's your opinion? Please send any comments to Andy MacAllister WA5ZIB, AMSAT VP User Services, 14714 Knights Way Drive, Houston, TX 77083-5640.

Plc	Call	Points	Group Name
1	K7TR	1206	Scottsdale ARC & Central AZ DX Assoc
2	WB6LLO	1047	North Shores Amateur Radio Club
3	W8MRM	368	Motor City Radio Club
4	IW0RFB	325	Lorenzo Raichini
5	W5IU	213	Lockheed Amateur Radio Club
6	K2CT	203	Albany Amateur Radio Assoc.
7	N8WSG	199	Kristi Smith *
8	N7SFI	176	Kohlwey Family
9	W3HZW	172	Kent County Amateur Radio Club
9	K7EFA	172	Yellowstone Radio Club
10	K4BFT	163	Huntsville Amateur Radio Club
11	NX2Q	158	The High Pointers
11	N5EM	158	AMSAT-Houston, HATS & the HTTY Club
12	KC7HP	137	Hellgate Amateur Radio Club
13	K4ZQX	136	Tom Cash
14	VE3TFP	134	West Carleton Amateur Radio Club

14	W5SC	134	San Antonio Radio Club
15	K8RO	117	L'Anse Creuse Amateur Radio Club
16	N2WM	102	Sussex County Amateur Radio Club
17	NM1K	99	The Hack Shack
18	W9LO	95	The Ozaukee Radio Club, Inc.
19	W1AW	93	The Naked Chicken Contest Club
20	AA8V	91	Appalachian Radio Amateur Assoc.
21	K6LY	86	Naval Postgrad. School & Galvin ARC
21	W8LLY	86	Bellbrook Amateur Radio Club
22	W5WX	68	Panhandle Amateur Radio Club
23	KD3UY	61	Bob Baker *
24	W4ABR	60	Johnson City ARC & East TN State U.
25	K3OPE	55	Bob's Mob
26	KK6IL	49	Ramora Outback Amateur Radio Society
27	WS8B	39	Xenia Weather Amateur Radio Net
28	VE7NOR	31	North Okanagan Radio Amateur Club
29	NN7N	25	Soper Hill Amateur Radio Club
30	N4NR	18	SCARC
31	HR2KOS	6	Lone Ricker

* Commercial power

Bob Myers W1XT for K7TR:

Field Day was lots of fun, but we need more CW operation. Probably need to reduce points for digital activity and increase points for CW!

Dave Guimont at WB6LLO:

AO-13 presented a very unfavorable position to San Diego, therefore the microsats were pursued with zeal. Competition on the low orbit birds made SSB contacts almost impossible. Fortunately we were not bothered by radar which makes the 9600-baud birds almost impossible to copy. AO-10 performed amazingly well most of the operating period. Signal strengths decreased toward the end of the period.

All operations were conducted using emergency power with a combination of gasoline generator and batteries. Station operators included WB6LLO, WB6BDY, KA6UCD, KD7BC, WB6GYP, W6EHR, W6ZBE and KC6NSE. Interested observers included Bill Bond, Connie Taylor, Jan Ahlman, David Ahlman and Jo Reynolds. This was the first exposure to satellite operations for many of the observers and participants. A discussion of the Phase 3D program was held during one of the longer periods of inactivity.

Mike Rudzki KF8BE for W8MRM:

We had an exceptional Field Day. Our operations this year moved more from the experimental stage to the "seasoned contest" level. All of our equipment went together quickly and without incident; usually a sure sign that something is wrong.

During our analog "off hours" we set up our station to upload/download to the

digital sats, which yielded our best digital score to date. Newly purchased M² antennas really helped.

Yet with all our success, it still seemed to us that there were fewer stations on the sats this year than in the past. Where did everyone go?

Bill Penny WM5U for W5IU:

Operators included W5IU, KG5OA, N5SVW and N5WOE. Equipment this year included KLM antennas, a Kenpro 5400 rotator system, Landwehr preamps, 9913 coax, Mirage amplifiers, a Yaesu FT-736R transceiver, a Kenwood TS-140 HF rig, a DSP-12 DSP TNC and a Kenwood R-1000 receiver.

Dave Jones WB2YLR for K2CT:

We had a great deal of interest in the WISP software and the 9600-baud satellite operation. We may need more 9600-baud satellites for FD 1996 to accommodate more users.

Sam Guccione K3BY for W3HZW:

Our much improved satellite station paid off. Added digital satellite capability for extra points. We were operating from Dover Air Force Base museum. The HF station was located in the cargo bay of a C-5 aircraft.

Vince Fiscus KB7ADL for K7EFA:

We worked a lot of fine satellite stations this year and hope to work all of them again next year.

Christie Harper KD4QIO for K4BFT (Big Fat Turkey):

We moved the satellite station slightly from last year and it improved our visibility tremendously (we were able to work AO-13 down to 1.5 degrees to the east). The LEO sats (RS-10/11 and RS-15) were a real mess with people trying to find themselves



Satellite station at W5WX near Amarillo, TX with W5FBQ "pounding brass" while KA0YOS logs.

We moved the satellite station slightly from last year and it improved our visibility tremendously (we were able to work AO-13 down to 1.5 degrees to the east). The LEO sats (RS-10/11 and RS-15) were a real mess with people trying to find themselves (carriers sweeping up and down the band). With our setup (x-beam on 10 meters) we only needed about 10-20 Watts to have strong downlink signal. We hope to be on the digital birds next year and to work Mode S.

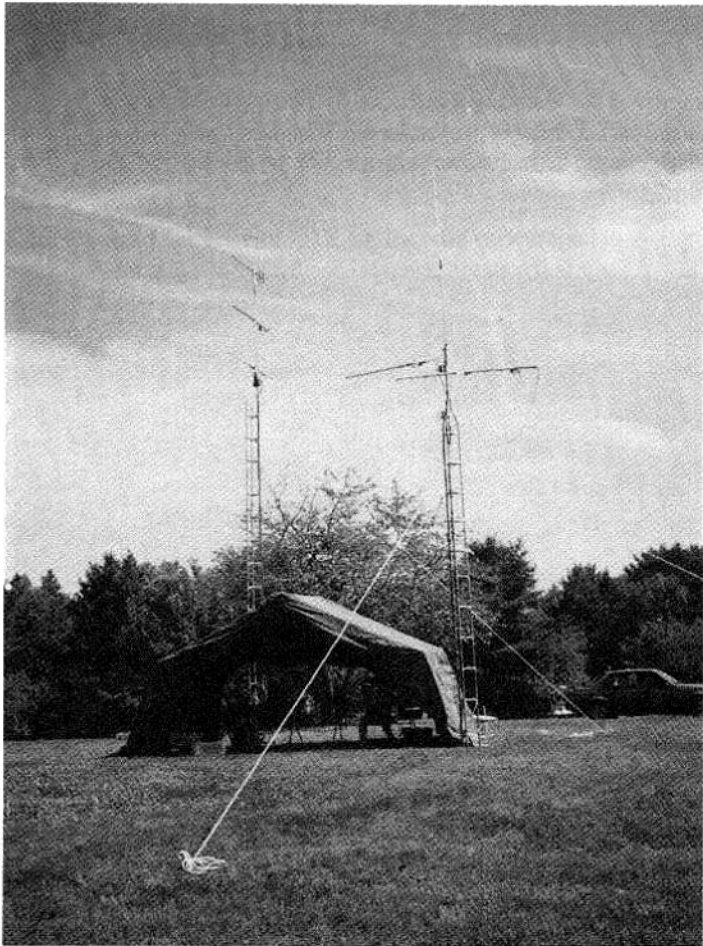
AO-13 was in great shape this year. When it switched out of Mode S, I worked about 19 stations before I realized the preamp was off.

Seemed to be a lot more DX stations on this year (worked 25 including UA6JR, ZF1DC and ZS6BTE). We would like to thank K7TR for helping us get straight on operating FO-20 and sticking through our QSO. We were on the wrong sideband.

Next year we will double check our antenna alignment. We started misaligned by about ten degrees in azimuth and five in elevation. We found that aligning with the sun was the easiest (assuming it's not raining) and double checking by rotating the antennas 180 degrees in azimuth and setting the elevation to the negative of the sun elevation.

Al Tencza NX2Q:

We set up on Friday at High Point, NJ. That night Dave N2AAM and NX2Q enjoyed working AO-13 Mode S with a



**VE3WCC, West Carleton ARC, Ontario, Canada,
1995 Field Day satellite station.**

four-foot solid dish mounted on a rotator 12 feet above the camper roof on a pneumatically telescoping mast. The possibility of strong winds persuaded us to remove the dish prior to the contest.

Goyne W2AF, a pioneer in the first UHF Relay at High Point in 1939, visited with our group and through his conversation and stories, W2AF gave us a special feeling of adventure by taking us back in time 56 years to activities at the same Field Day site.

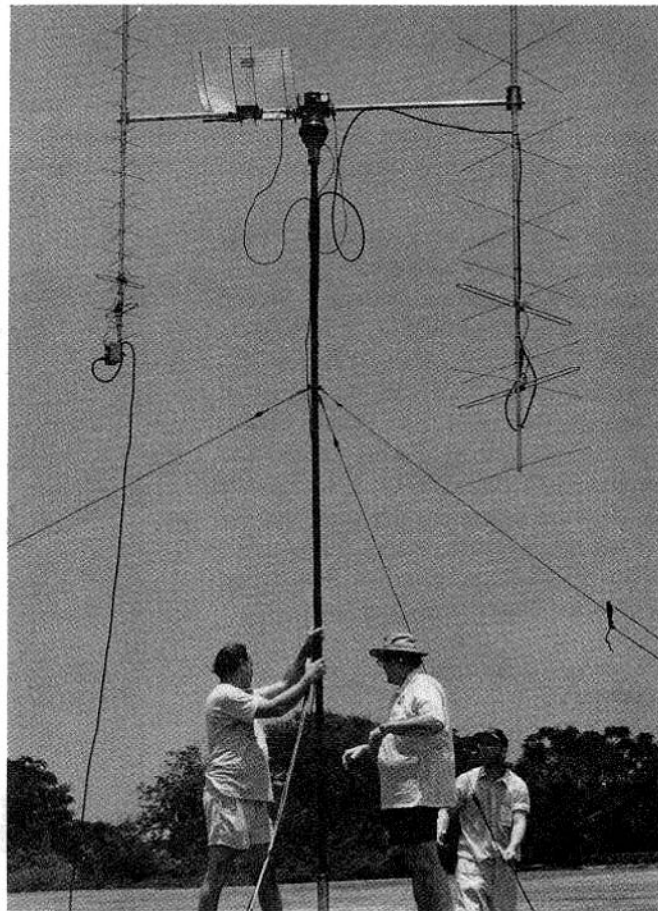
We finally worked RS-15 by teaming up; W2OZU on the CW key, NX2Q on the Doppler knob, KF2KN on the antenna rotator buttons and WA2JHN with the pencil.

KF2KN and KE2SL managed to work terrestrial packet, but alas, no digital satellite downloads this time. NJ2Y, N2SWG and KE2SL spent many hours troubleshooting gremlins.

Andy MacAllister WA5ZIB for N5EM:

AO-10, AO-13, FO-20, RS-10/11, RS-15, UO-22, KO-23 and KO-25; all with less than five Watts on the uplink! For us the best part was getting through a pileup on AO-13 Mode B and making some Mode S contacts in the wee hours of Sunday morning. We had some TE-Systems amplifiers "in the bag", but never had to get them out. Next year we'll try for more aluminum and continue the QRP experiment.

Vick Applegate WA7DEO for KC7HP:



**WA5TWT, N5XGW and KC5LWY get the N5EM
satellite antennas ready for Field Day, Fort Travis
Seashore Park, TX.**

The birds were again quite active. Both AO-10 and AO-13 performed very well. AO-10 continues to be a pleasant surprise and provided us with nearly as many contacts as AO-13.

Thanks again to AMSAT for sponsoring this event. For us, it was another opportunity for some new operators to become enthused with satellites.

Tom Cash K4ZQX:

High angle AOS on AO-10 prevented activity on Saturday and limited activity on Sunday. I'm blocked to the west by Signal Mountain. I could have worked a lot of Europeans, but most were not making Field Day style contacts. All in all, the signals were great, the satellite ham community was professional and polite, and in time, I'm sure I'll recover from sitting up all night.

**Steve Cerwin
W5FRE for
W5SC:**

Enjoyed Field Day as usual! I had some difficulty getting this form and finding out where to send it.

**Tom Mathison
WU8C for K8RO:**

The satellite station at our Field Day site was the most visited and by far the most interesting of our activities this year. Too bad about AO-13 saying good bye toward the end of next year. It is by far the most productive satellite. I look forward to doing this again next year.

John Santillo N2HMM for N2WM:

Field Day was held behind the main branch of the Sussex County (NJ) Library to provide more visibility for amateur radio and the Sussex County ARC. The weather was typical for NW New Jersey on Field Day weekend. Friday and Saturday were damp, on Sunday we baked. The antenna gremlins also came out for the weekend. Almost every antenna at the N2WM site had to be lowered and repaired. This went double for the satellite station. It was not fully operational until 0430 UTC on June 25th! Over ten hours were lost to technical difficulties.

Generally I think the satellites performed very well. AO-13 Mode B worked very well. AO-10 signals were weak and QSO's were difficult. FO-20 provided strong signals with a lot of good contacts. This FD was the first real exposure I had with RS-15 and I'm sold on it. I only made one contact on RS-10/11. I heard myself most of the time, but many stations appeared to have a hard time finding themselves. AO-27 was chaotic! I could not hold the

transponder long enough to complete a contact. I didn't have the equipment for RS-12/13 for Mode K.

To me Field Day is the premier contest of the year and the AMSAT competition makes it all worthwhile. The contest provides some great competition. This year I worked W1AW on almost every satellite.

Rusty Hack NM1K:

This was the first AMSAT Field Day for us. The "Hacks" include Russ (dad) KA1VEC, Edith (mom) KA1VED, and Rusty NM1K.

**Peter Budnik
KB1HY for
W1AW:**

Great AO-13 pass, but next year, how about a daytime pass!?! The second operator was Steve Ford WB8IMY.

**Gary Bargholz
N9UUR for W9LO:**

We were all set up for the digital satellites, but no luck. I think too much hum and buzz from the generated power interfered with the TNC. Plenty of signal, but no decode. Next year... total battery powered

digital satellite ground station at Field Day...it's already in the works!

Pat Woods N3AAS for AA8V:

Not a bad effort for only ten Watts. We made twice as many contacts this year than last. Thanks for everyone's patience.

Gerd Schrick WB8IFM for W8LLY:

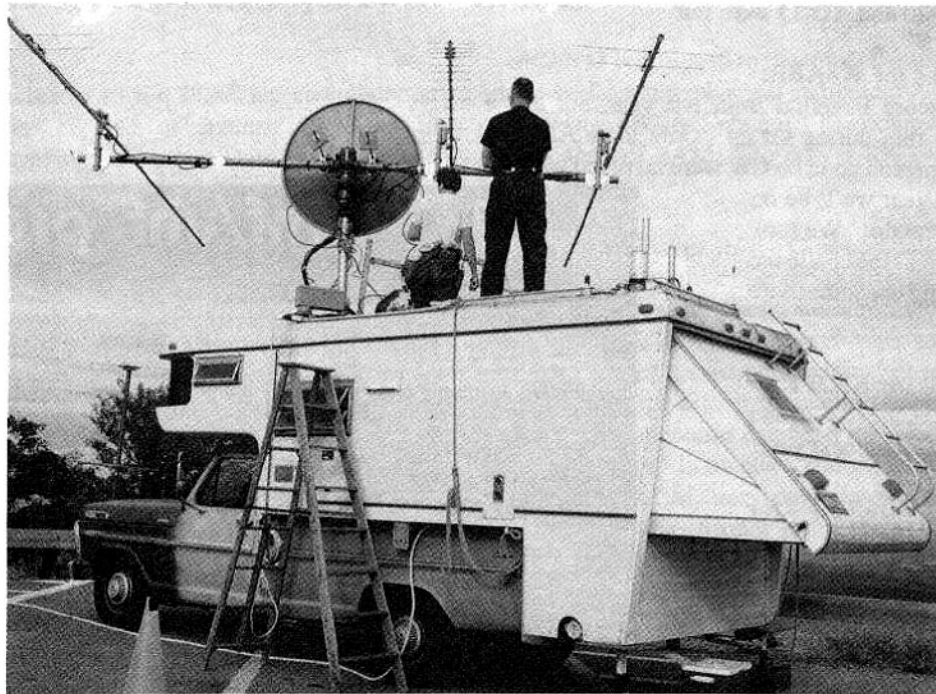
Mode S was attempted. We heard one station WC8JC calling CQ and we could hear our own signal, but only weakly. Some DX was also heard, but no contacts were completed.

Steven Bible N7HPR for K6LY:

We had some troubles with the 440 antenna. It was 99 degrees in the shade!

Joe Mayfield KA0YOS for W5WX:

Murphy struck big this year at W5WX! We ran a dry run the week before Field Day and things went flawlessly, but when the big day came, things went differently. Sometime between the dry run and Field Day our transponder frequency chart vanished. We dropped an antenna on the way to the site breaking the feed section. This required repairs during valuable operating time. When it was all over we discovered Murphy had eaten an entire page of our log



NX2Q (standing) and N2SWG, getting ready to elevate the antenna array at High Point, NJ (Photo Les Crine, NX2Q)

taking all of our AO-10 contacts (estimated at 30). Anyway, we had fun, the weather was beautiful, the barbecue was fantastic, and several operators got to make their first OSCAR contacts. To the best of knowledge the Panhandle ARC had seven ops at the satellite station during the event including Joe Mayfield KA0YOS, Bob Hill W5FBQ, Aaron Sims KJ5ER, David Williams KK5KK, Marshall Cook AB5ZA, David Hundley KB5WUF and Matt Carpenter KC5CGT.

Bob Baker KD3UY:

RS-10/11 was so busy I gave up on it. Ditto for RS-12/13, RS-15 and AO-27. FO-20 and AO-13 were fine.

Anna Osborn WS4Z for W4ABR:

We increased our score threefold from last year, but lost a couple of hours due to rain during set up. Only three AMSAT people and one non-sat person good on CW were involved with the satellite activity. Next year we'll be on Mode S and the digital modes. We took some hints from K7TR and the challenge to do better... but we could use some more members.

Jim Huhta AA4MD for K3OPE:

Lost power for most of the AO-10 and AO-13 times. We'll try again next year!

Chuck Carlson KD6RSQ for KK6IL:

We set up in a shopping center parking lot. Lots of people came by wondering what we were doing. It was a VERY hot day in southern California!

Keith Baker KB1SF for WS8B:

This was an EXCELLENT way to get others in the club up and on the birds! For all it was also great fun!

Charlie Panek KX7L for NN7N:

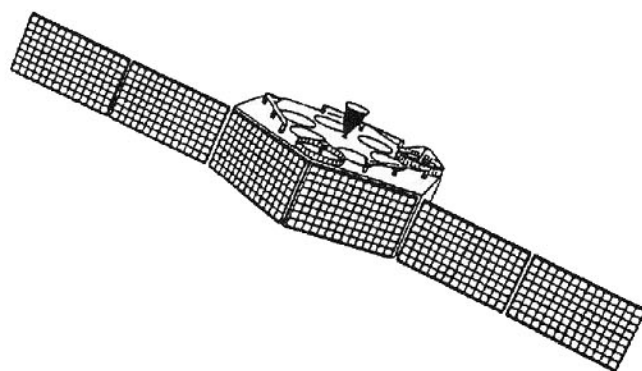
Our score would have been better this year if I'd figured out sooner that our two-meter turnstile antenna was bad. As a result, it was mostly RS-12/13 this year for us. Can't wait for Phase 3D!

Ken Bishop, WD4AAI for N4NR:

Even though we had a bad location to shoot the birds, we had a good time. Unfortunately, the best time for QSOs were not good for visitors.

Ricardo Denis HR2KOS:

I am not sure about the Field Day classification for my DX entry. I ran two transceivers off a car battery. This was my first Field Day! ■



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P50VDG	50-54	< 0.5	24	+12	GaAsFET	\$79.95
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P144VDG	144-148	< 0.5	24	+12	GaAsFET	\$79.95
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P220VDA	220-225	< 1.2	15	0	DGFET	\$37.95
P220VDG	220-225	< 0.5	20	+12	GaAsFET	\$79.95
P432VD	420-450	< 1.8	15	-20	Bipolar	\$32.95
P432VDA	420-450	< 1.1	17	-20	Bipolar	\$49.95
P432VDG	420-450	< 0.5	16	+12	GaAsFET	\$79.95

Inline (rf switched)						
SP28VD	28-30	< 1.2	15	0	DGFET	\$59.95
SP50VD	50-54	< 1.4	15	0	DGFET	\$59.95
SP50VDG	50-54	< 0.55	24	+12	GaAsFET	\$109.95
SP144VD	144-148	< 1.6	15	0	DGFET	\$59.95
SP144VDA	144-148	< 1.1	15	0	DGFET	\$67.95
SP144VDG	144-148	< 0.55	24	+12	GaAsFET	\$109.95
SP220VD	220-225	< 1.9	15	0	DGFET	\$59.95
SP220VDA	220-225	< 1.3	15	0	DGFET	\$67.95
SP220VDG	220-225	< 0.55	20	+12	GaAsFET	\$109.95
SP432VD	420-450	< 1.9	15	-20	Bipolar	\$62.95
SP432VDA	420-450	< 1.2	17	-20	Bipolar	\$79.95
SP432VDG	420-450	< 0.55	16	+12	GaAsFET	\$109.95

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AMSAT Windows Software

WiSP - This enthusiastically received new program by ZL2TPO provides all the facilities needed to operate the digital Amateur Radio satellites. It is the first widely used alternative to the *PB* and *PG* programs that have been the mainstay since the digital satellites began. *WiSP* is a suite of programs that operate under *Windows* to do these things plus integrating commonly used hardware for control of antennae and rig for setting frequencies and tracking of Doppler shift using the driver written by KC6WYG (included).

The equipment requirements to run *WiSP* are essentially an IBM-compatible computer capable of running *Windows* in enhanced mode. It performs well with machines as modest as a 386DX/25 if they have a math coprocessor. Four MB of RAM is recommended. Any machine less than a 486 should have a math coprocessor.

If you are active on the Pacsats and you are not running *WiSP*, you are probably working too hard! The program is available for downloading directly from the satellites, the AMSAT ftp site on Internet, BBSs and other sources, but you need to register it by donating \$40 (\$50 for non-members) to AMSAT. A copy on disk along with a registration number may be obtained for \$50 (\$60 for non-members) by ordering from AMSAT.

WINSAT - A *Windows*-based satellite tracking program KA7LDN that displays calculated orbital data and other information such as azimuth and elevation in a text window. It also shows the satellite location on two dynamically-updated map

views. *WINSAT* can track several satellites simultaneously. In this case, each satellite has its own tracking window. The satellite database can store orbital elements for over 100 spacecraft and, in addition, will store other information such as transponder schedule and antenna orientation. The database can be modified manually or may be updated from a NASA- or AMSAT-standard element text file. Can control antennas using the driver written by KC6WYG.

WINSAT is designed to run under the *Windows* environment on higher-performance personal computers such as the 386 with math coprocessor, 486, or Pentium. The computer should also contain at least 4MB of RAM. The cost is \$30 for members and \$50 for non-members.

UP/DOWN - For IBM-PC or compatibles. *UP/DOWN* is an Amateur Radio satellite operations aid program. It provides uplink to downlink frequency conversions, technical data, history, beacon frequencies, modes available, and other useful information about satellites. Provisions are included for the user to enter new satellites or modify existing data in the satellite database. It is written to run on an IBM compatible computer equipped with EGA or VGA graphics in color. In its black and white mode, it will also run on CGA machines. Memory requirements are minimal by today's standards. For the operator just getting started in Amateur Radio satellites, this program provides a ready reference for valuable information about all of the birds in one convenient place. Both DOS and *Windows* versions are provided. Members and non-members \$25.

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JAS-2 Now Under Preparation

Fujio Yamashita, JS1UKR
JARL Technical Laboratory
rgd02520@niftyserve.or.jp

Introduction

On August 12, 1986 at 2045 UTC, JAS-1 was launched from Tanegashima Space Centre by the National Space Development Agency of Japan (NASDA). On board with the Geodetic Experimental Payload during the first test of the H-1 launch vehicle, the bird was thrown into an orbit of 50 degrees of inclination and 1500

km of altitude. The name Fuji-OSCAR 12 (FO-12) was given by AMSAT to Japan's first amateur satellite.

Some two decades ago prior to FO-12, the Japan Amateur Radio Relay (JARL) had planned to launch an amateur satellite by partnering with related space development organizations. At that time, Japan AMSAT (JAMSAT) was working on satellite experiments including construction of a Mode J transponder for OSCAR 8. JARL established a Satellite Committee, in which JAMSAT members joined to take part in preparing plans to construct a new satellite.

The members of the Satellite Committee had been enthusiastic about constructing Japan's first amateur satellite. Using free time between normal work hours, satellite transponders were built using volunteer software and hardware skills. The total amount of time devoted to building FO-12 exceeded 20,000 hours. In addition, international assistance was also provided during the construction of FO-12.

As a result, two JAS-1 satellites, called PFM and FM, were constructed. FM was launched first and was designated Fuji OSCAR 12 (FO-12). FO-12 worked for the entire three years of its design life and

AMSAT HF & VHF Voice Nets

Net Designation	Day	Time	Freq.	NCS
<i>International:</i>				
AMSATSouth Pacific	Saturday	2200 UTC	14.282 MHz	ZL1WN
AMSAT International	Sunday	1900 UTC	14.282 MHz	W5IU
AMSAT International ¹	Sunday	1900 UTC	21.280 MHz	W8GQW
AMSAT International ¹	Sunday	2300 UTC	18.155 MHz	N4QQ
<i>Regional (USA):</i>				
AMSAT-NA East Coast	Tuesday	2100 Local	3.840 MHz	W8GUS
AMSAT-NA Mid-America	Tuesday	2100 Local	3.840 MHz	W0CY
AMSAT-NA West Coast	Tuesday	2000 Local	3.840 MHz	K6OYY
<i>Local:</i>				
AR-LA-TX QCWA Net ²	Monday	1930 Local ³	146.670 MHz	WA9PZL
Boston Area SPOT Net	Friday	2100 Local	145.230 MHz	N1GKE
Central Calif. (Fresno) Net	Sunday	2000 Local	146.940 MHz	WA6YDI
Central NY AMSAT Rndtbl.	Monday	2000 Local	146.880 MHz	WA2EXJ
Central Ohio Sat. Interest Gp.	Sunday	2000 Local	145.490 MHz	WB8LUJ
Colorado AMSAT Net	Wednesday	2000 Local	147.225 MHz	WD0HHU
Dallas/Ft. Worth AMSAT Net	Wednesday	1945 Local	147.140 MHz	Various
Detroit AMSAT Net	Thursday	2000 Local	145.330 MHz	N8QGC
Harrisburg, PA AMSAT Net	Sunday	2000 Local	145.210 MHz	KA3TKW
Houston Area AMSAT Net	Tuesday	2200 Local	147.100 MHz ⁴	WA5ZIB
Long Island NY AMSAT Net	Tuesday	2000 Local	147.075 MHz	WB2UZR
S.W. Ohio AMSAT Net	Tuesday	2000 Local	141.410 MHz	N8NPX
S. Central Ohio AMSAT Net	Wednesday	2100 Local	146.925 MHz	N8AJD
Tucson Area AMSAT Net	Wednesday	1900 Local	146.880 MHz	NW7N
Washington, DC Area Net	Sunday	2100 Local	146.835 MHz	WD8LAQ

Notes:

- 1) Nets suspended temporarily due to poor band conditions.
- 2) NCS is in Shreveport, LA.
- 3) 2000 CDT during summer.
- 4) Simulcast on other ham frequencies and Telstar 302, TR. 21, 5.8 MHz audio subcarrier. Contact NCS for details.

stopped operation due to lack of generated power. FO-12 is noted as the first operational flying Amateur Radio Satellite BBS. PFM, was launched on February 7, 1990 and was named Fuji OSCAR 20 (FO-20). FO-20 included improved power performance gallium arsenide cells instead of the silicon cells used by FO-12. Low earth orbit satellites are often exposed to a radiation field which have deteriorating effect on solar cells. While FO-12's power decreased more quickly than expected, FO-20 gallium arsenide cells have demonstrated slower decrease of power

generation allowing current FO-20 operation.

JAS-1 satellites are characterized by two kinds of transponders for analog and digital operation. An analog transponder allows linear real-time relaying in Mode JA, while Mode JD provides a 1200 bps BBS. Presently, there are many digital Amateur Radio Satellites in service, however, FO-20 is unique as it carries a linear transponder for analog communication allowing QSO enjoyment for analog mode users.

JAS-2 Plan

Today, five years after launch, FO-20 is still working but telemetry suggests that it will cease operation in near future, as solar power generation is gradually decreasing.

JARL recognizes the importance of having a low earth orbit Amateur Radio satellite with an analog linear transponder for beginner's use. Such a satellite will allow beginners to make low power QSOs using a tracking antenna and adjusting for Doppler shift. As a result, even a lightly-equipped beginner can have the joy of hearing one's voice through a loop test of a low earth orbit Amateur Radio satellite.

In response to this need, JARL recently decided to construct and launch a third satellite as successor to FO-20. Similar to FO-20, this satellite will provide analog (Mode JA) QSOs, as well as a packet (Mode JD) BBS in a low earth orbit. *We will call the next bird JAS-2!*

What is JAS-2?

Similar to FO-20, JAS-2 is a 26-faced polyhedron (Figure 1 and 2) and weighs approximately 50 kg. The JAS-2 system diagram is provided as Figure 3 and its specifications are:

Transponders:

A. Linear transponder for analog communication in Mode JA:

Uplink: 145.900 - 146.000 MHz
Downlink: 435.800 - 435.900 MHz
 (inverted spectrum to the uplink)
Output Power: 1 Watt

B. Digital transponder for packet BBS in Mode JD:

Uplink: 145.850, .870, .890, .910 MHz, NRZ-I bi-phase-FM for 1200 bps and NRZ-L FSK for 9600 bps.
Downlink: 435.910 MHz, NRZ-I PSK for 1200 bps and NRZ-L FSK for 9600 bps
Bit Rate: 1200 or 9600 bps, switchable by ground command

C. Digitalker

Mode: FM voice, maximum 25 seconds for message

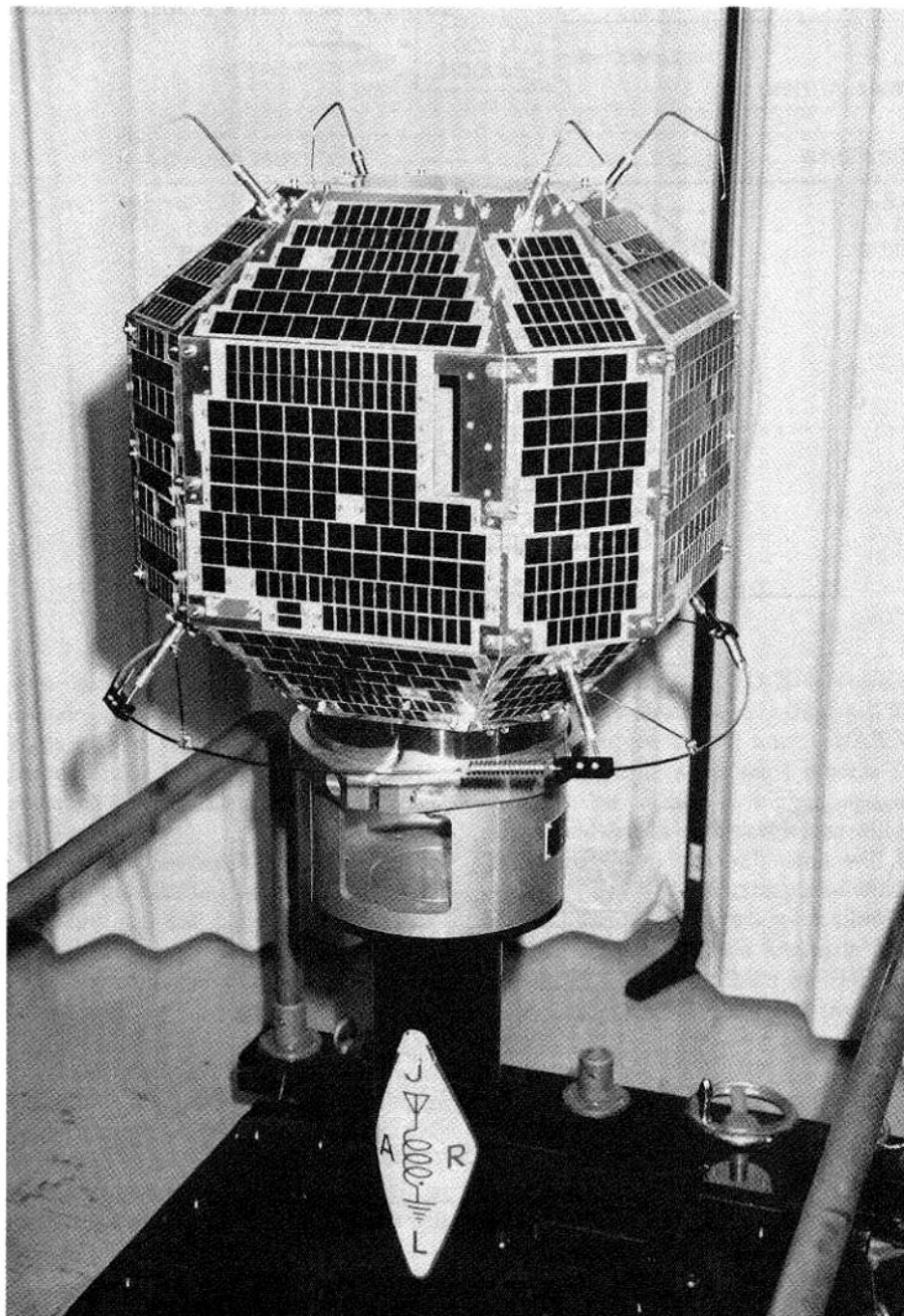


Figure 1. JAS-2

Downlink: 435.91 MHz.

Output Power: 1 Watt.

Antennas: When the attitude of JAS-2 is stable, polarization can be predicted for every pass. Antenna directions for both uplink and downlink are not always uniform around the spin axis, which may cause spin modulation.

A. Receiving Antenna: Ring-shaped turnstile, maximum gain is 0 dB. The receiving 2-meter antenna is sensitive to right-hand polarization looking at the top part of the body. Around the sub-satellite belt, linear polarization in a direction of a satellite pass is better for uplink.

B. Transmitting Antenna: Turnstile, maximum gain is 0 dB. The transmitting antenna is used by the analog and digital transponders through an antenna combiner where polarization is opposite to each other.

Power Supply: Gallium arsenide cell (700 pieces of 2cm x 2cm and 748 pieces of 2cm x 1cm). The storage battery consists of 11 nickel-cadmium cells, with a 6 Ampere-hour capacity.

Orbit: The orbit of JAS-2 will be polar, with perigee around 800 km and expected apogee of approximately 1500 km. Inclination will be 99 degrees.

System Control: JAS-2's sub-system is a commercial V50 CPU, a 16 bit processor with a 4 MHz clock and 2 megabytes of SRAM memory.

Operation Notes:

A. The analog transponder is similar to FO-20 with uplink bandwidth of 100 kHz between 145.900 and 146.000 MHz and downlink bandwidth between 435.800 and 435.900 MHz (inverted to the uplink).

B. In the digital mode, the following four uplink channels are available for 1200 bps packet: 145.850, 145.870, 145.890 and 145.910 MHz. Downlink is 435.910 MHz. For the 9600 bps packet uplink, the only usable channel is 145.870 MHz. Downlink for 9600 bps packet is 435.910 MHz (same frequency as 1200 bps).

C. Occasionally, a digitalker will be activated by ground control station, to draw attention to newcomers interested in Amateur Radio satellites. The BBS frequency (435.910 MHz) is the same as the

digitalker frequency and must be shut down during digitalker operations.

d. Simultaneous analog and digital mode operation is very difficult due to solar power limitation. As a result, analog and digital will usually be available on a rotating basis. This also will be the case with 1200 bps and 9600 bps operations. An operation schedule will be announced after launch. If solar power is high enough, as in the case during an no-eclipse period, both of the analog and digital transponders will operate simultaneously.

e. Satellite maintenance will be necessary if BBS malfunctions or power

supply anomalies occur. Maintenance may be performed without notice to users.

JAS-2 Features

A. The size, weight and shape of JAS-2 are quite similar to those of FO-20, however, the transmitting antennas are slightly different due to limitation of the payload envelope inside the faring.

B. A new attitude control system will be employed combining solar and geomagnetic sensors. Two coils will provide suitable torque to spin the satellite

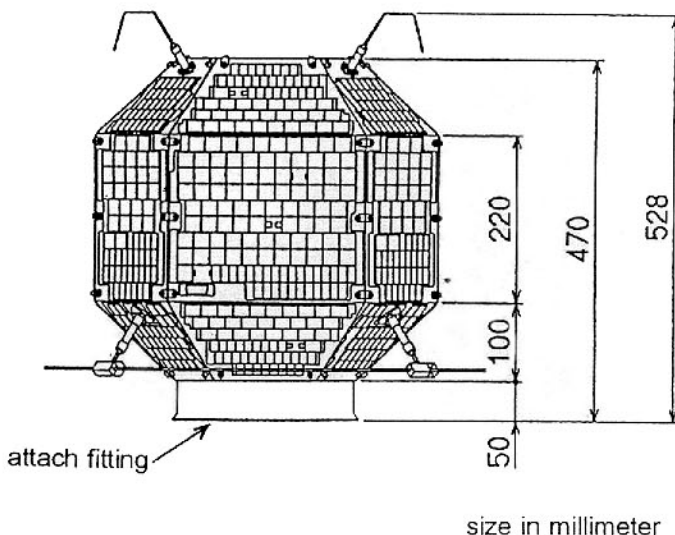
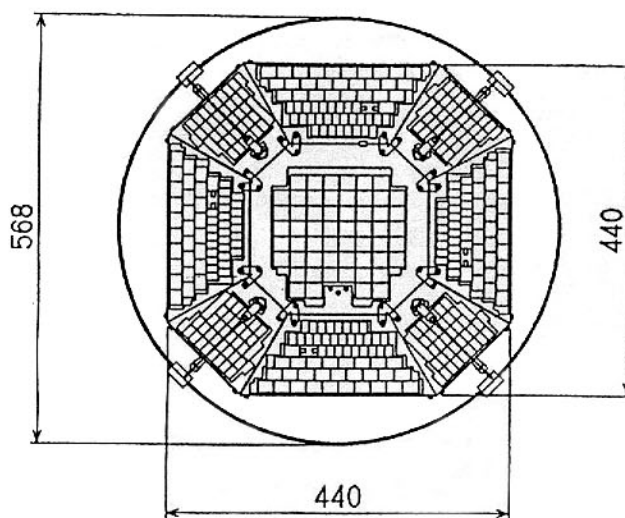


Figure 2. JAS-2 Dimensions

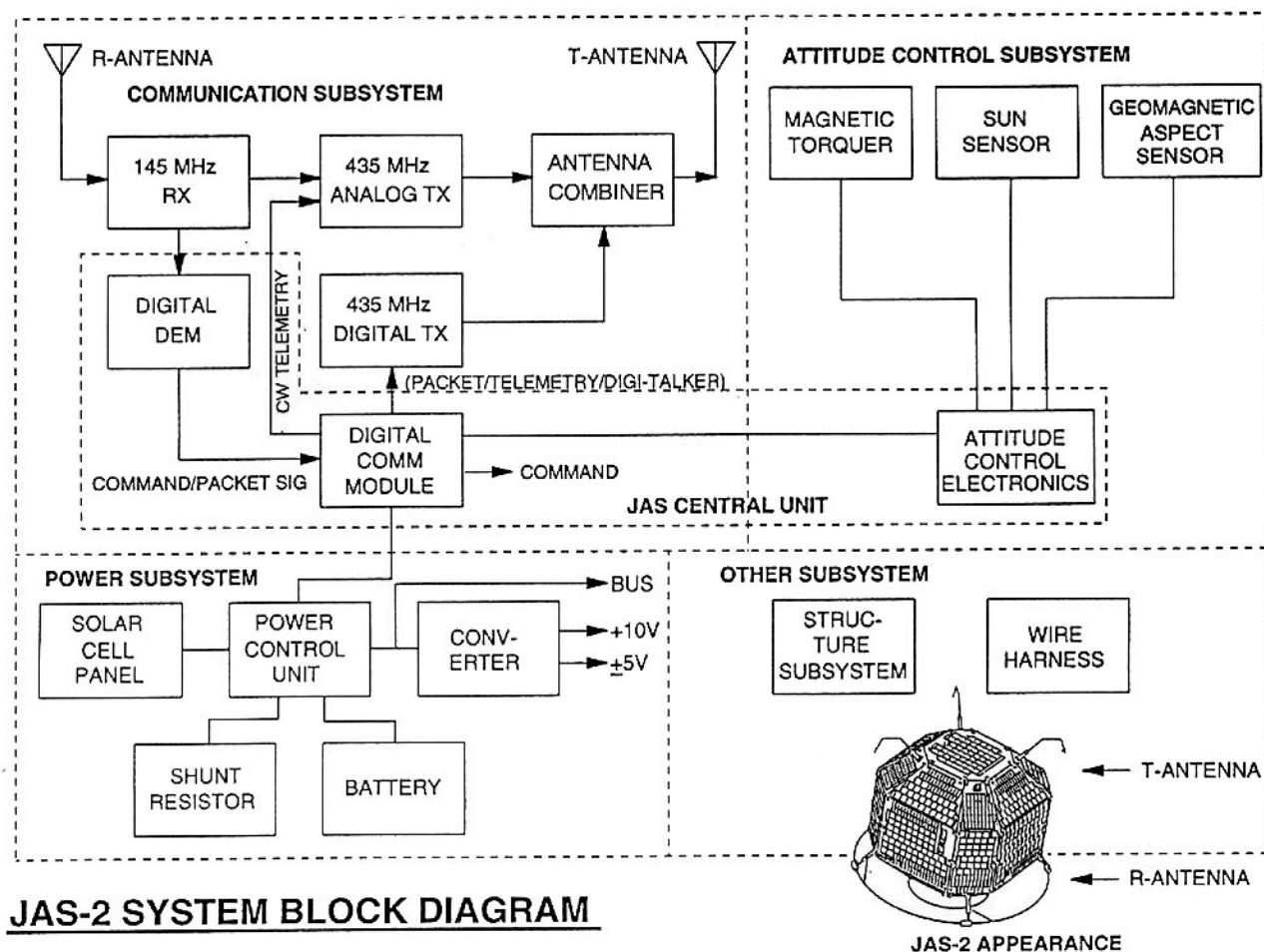


Figure 3.

with geomagnetic reaction keeping its attitude properly beaming towards the earth. The spin axis will be kept perpendicular to the orbit plane, in the so-called *Wheel Mode* (Figure 4).

C. Gallium-arsenide cells are used for power generation because of good immunity against high energy particles around the earth. Conversion efficiency from optical to electrical energy is approximately 17 percent.

D. We have asked NASDA and related organizations to launch JAS-2 at the earliest convenience. We have obtained a chance for launch in August or September 1996 as a secondary payload to the *ADEOS*, an earth-observing satellite. *ADEOS* will have a polar circular orbit of altitude of 800 km allowing JAS-2 to go into a similar orbit. Less fun can be had with such an orbit for Radio Amateurs! After launch of FO-20, a second stage rocket was re-fired after separation of main payload to raise

apogee. After the burn, FO-20 was ejected into its orbit with an apogee as high as 1700 km and perigee at 940 km. NASDA intends to perform the same process for JAS-2 to allow a higher apogee. Additional details on this orbit plan will be announced later. JAS-2's orbit will be similar to that of FO-20; orbit period will be a little bit shorter than two hours allowing six passes a day. While low earth orbit causes large Doppler shifts in VHF and UHF bands, most users can overcome these effects.

Telemetry: JAS-2 has two modes of telemetry; CW and packet. CW telemetry data will be sent on 435.795 MHz at 12 words per minute. One frame of telemetry consists of 24 elements of three-digit-number, HI HI at the head. Format of CW telemetry data is as follows:

HI HI 1A 1B 1C 1D 2A 2B 2C 2D 3A 3B
3C 3D
4A 4B 4C 4D 5A 5B 5C 5D 6A 6B 6C 6D

A, B, C and D represent two digits of hexadecimal, each digit corresponds to 4 bits. 1A through 2A are system status data, and 2B through 6D are observed analog data N (Table 1).

Mail Box/BBS

Mailbox of JAS-2 is almost the same as that of FO-20. While JAS-2's callsign has not been given, user's command of mailbox is very similar to other digital satellites. JAS-2 has no digipeater function and available commands are provided as Table 2.

Conclusions

Looking around the field of Amateur Radio satellites, there are many sophisticated and easy-to-use satellites. Among those satellites, JAS-2 seems now something classic as it still employs an analog transponder package. JAS-2 will

JAS-2 Telemetry

System Status Data

Bit	Status Item	1	0	
1A				
0	main relay	on	off	MSB of 1st 4 bits
1	DCM	on	off	
2	SRAM	on	off	
3	packet 1200	1200	9600 or off	LSB of 1st 4 bits
4	packet 9600	9600	1200 or off	MSB of 2nd 4 bits
5	JTA	on	off	
6	JTD	on	off	
7	geomagnetic sensor	on	off	LSB of 2nd 4 bits
1B				
0	solar sensor	on	off	
1	UVC control	on	off	
2	UVC level	2	1	
3	mode of PCU	manual	auto	
4	PCU level 1/2	2	1 or 3	
5	PCU level 3	3	1 or 2	
6	battery charging mode	trickle	full	
7	battery logic	full	trickle	
1C				
0				
1				
2				
3				
4	digitalker	on	off	
5				
6	mode of UVC	on	off	
7	CPU run/reset	on	off	

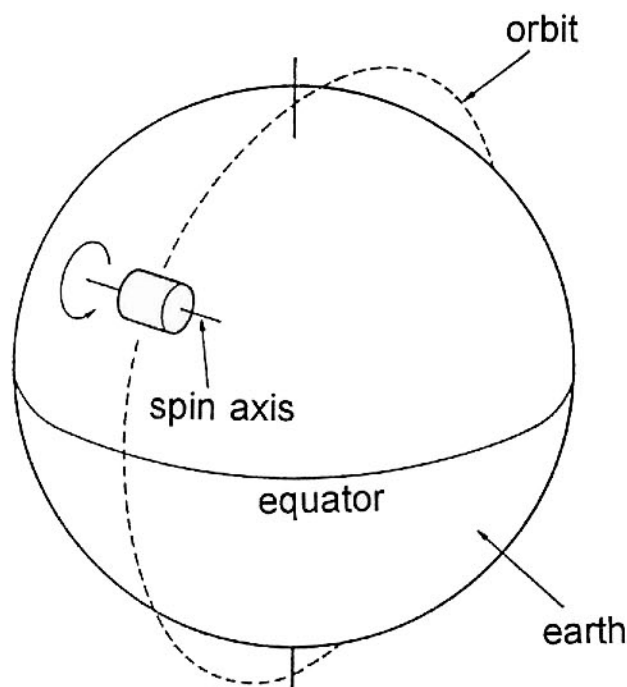
[1D and 2A are not assigned.]

Measured Analog Data

Bit	Item	Reduction Formula ¹
2B		
2C	spinning rate	
2D	spinning rate	
3A	status of attitude	
3B	solar angle	
3C	geomagnetic sensor Y	
3D	geomagnetic sensor Z	
4A	solar panel current	$I=0.009765*N$ A
4B	charging/discharging current	$I=-(2-0.01953*N)$ A
4C	terminal voltage of battery	$V=0.10761*N$ V
4D	middle point voltage of battery	$V=0.04814*N$ V
5A	bus voltage	$V=0.09843*N$ V
5B	JTA transmitting power	$P=-4.66+2.13e-1*N$ dBm
5C	temperature of body 1	$T=(1.95321-N*19.53e-3)/0.02039$ Celsius deg
5D	temperature of body 2	$T=(1.95321-N*19.53e-3)/0.02039$ Celsius deg
6A	temperature of body 3	$T=(1.95321-N*19.53e-3)/0.02039$ Celsius deg
6B	temperature of body 4	$T=(1.95321-N*19.53e-3)/0.02039$ Celsius deg
6C	temperature of battery	$T=(1.95321-N*19.53e-3)/0.02039$ Celsius deg
6D	—	

1. These are preliminary descriptions. Final reduction formulae will be announced later including digital telemetry reading.

Table 1. JAS-2 Telemetry



JAS-2 IN WHEEL MODE

Figure 4.

teach newcomers several techniques such as; how to make voice contacts on Amateur Radio satellites, low earth orbit satellite characteristics, Doppler shift, sunlight condition, and so on. *So why don't you make plans to enjoy JAS-2 too?* Further JAS-2 information will be announced later via the AMSAT News Service, AMSAT-BB and especially on JAS-2 telemetry.

Matching Funds for P-3D Contributions to AMSAT

We have been informed by a foundation, which prefers to remain anonymous, that they will match \$ for \$ all P-3D contributions made directly to AMSAT thru the end of 1995.

Three payments have already been received.

Command	Description
A	User's command
B	Bulletin; lists file headers addressed to all.
F	Lists the latest file header and those in reverse order of time.
FDD <MM/DD>	Lists file headers in reverse order of time from MM/DD.
H	Help, shows list of commands and their explanation.
K <nnnn>	Deletes file, possible by posted and addressed station only.
M	Lists file headers addressed to user.
R <nnnn>	Shows message of file.
U	Lists current users.
W	Writes messages, sender is requested address and title of message, after that messages are sent, and termination of message should be expressed 14, return at the line head.
Y	Requests more display for B and F commands.
Q	Requests disconnection of current link.

JAS-2 TNC Settings:

Item	Setting
FULLDUP	ON
MAXFRAMES	4
PACLEN	128 or less

If there is a *SOFTDCD* command, turn it OFF.

Table 2. FO-20 User commands

Current Amateur Satellite Frequencies

Analog Satellites

Satellite	Beacon (MHz)	Uplink (MHz)	Downlink (MHz) ¹	Type
AO-10 ²	145.810 and 145.987 ³	435.030-435.180 LSB/CW	145.975-145.825 USB/CW	Mode B
AO-13 ²	145.812 and 145.985 ⁴	435.423-435.573 LSB/CW	145.975-145.825 USB/CW	Mode B
AO-13	2400.661 ⁴	435.603-435.639 USB/CW	2400.711-2400.749 USB/CW	Mode S
AO-27		145.850 FM	436.800 FM	Part-Time Repeater
FO-20 ⁵	435.795	145.900-146.000 SSB/CW	435.800-435.900 SSB/CW	Mode JA
RS-10 ⁶	29.357	145.865-145.905 USB/CW	29.360-29.400	Mode A
RS-12 ⁷	29.408	21.210-21.250 USB/CW	29.410-29.450	Mode K
RS-15	29.352	145.858-145.898 USB/CW	29.354-29.394	Mode A

Digital Satellites

Satellite ⁸	Name or Callsign	Uplink (MHz)	Downlink (MHz) ¹	Type
UO-11			145.825 FM	1200 Baud PSK
AO-16	PACSAT	145.900, .920, .940, .960 FM	437.0513 SSB	1200 Baud PSK
DO-17	DOVE		145.825 FM	1200 Baud AFSK
WO-18 ⁹	WEBERSAT		437.104 SSB	1200 Baud PSK AX.25
LO-19	LUSAT	145.840, .860, .880, .900 FM	437.1528 SSB	1200 Baud PSK AX.25
UO-22	UOSAT5	145.900, .975 FM	435.120 FM	9600 Baud FSK
KO-23	HL01	145.850, .900 FM	435.175 FM	9600 Baud FSK
KO-25	HL02	145.870 FM	436.500 FM	9600 Baud FSK
IO-26	ITMSAT	145.875, .900, .925, .950 FM	435.822 SSB	1200 Baud PSK
POSAT	POSAT1	145.975 FM	435.2777 FM	9600 Baud FSK

MIR and SAREX

Spacecraft	Callsign	Uplink (MHz)	Downlink (MHz) ¹	Type
Mir	ROMIR	145.550 FM	145.550 FM	Simplex Voice or Packet
Mir	DPOMIR ¹⁰	145.200 FM	145.800 FM	Duplex Voice
Mir	DPOMIR ¹⁰	435.725 FM	437.925 FM	Voice
Mir	DPOMIR ¹⁰	435.775-436.775@25kHz spacing	437.975 FM	9600 Baud Packet
Shuttle	WSRRR	144.490 FM ¹¹	145.550 FM	Packet
Shuttle	Various	144.910, .93, .95, .97, .99 FM ¹¹	145.550 FM	Voice (Except Europe)
Shuttle	Various	144.700, .750, .800 FM ¹¹	145.550 FM	Voice (Europe only)

Notes:

- 1) Frequencies are shown without Doppler compensation. At start of typical LEO pass, the original signal will be several kHz higher than shown. Refer to specific satellite operating instructions for complete details.
- 2) For AO-10 and AO-13 Mode B, transmit in LSB, receive in USB. Also in Mode B, when the transmitted frequency is increased the received frequency will decrease (inverting transponder). AO-10 is no longer controllable but the transponder works when the satellite is in sunlight.
- 3) AO-10 beacon is an unmodulated carrier. Do not transmit to the satellite if the beacon is FMing.
- 4) AO-13 beacon sends CW at beginning of the hour and 30 minutes past the hour, RTTY at 67 wpm at 15 and 45 minutes past hour, and 400 bps rest of the time.
- 5) Presently, FO-20 digital JD mode is not operational.
- 6) RS-10 Robot via 145.820 MHz uplink and 29.403 MHz downlink.
- 7) RS-12 Robot via 21.129 MHz uplink and 29.454 MHz downlink.
- 8) Digital satellites use a program suite containing PB/PG/PFHADD/PHS or WiSP.
- 9) WO-18 transmit experimental and image data and can be captured in KISS mode via PB or TLMDC.
- 10) Tentative frequencies for SAFEXII during EUROMIR '95 (3SEP95 - 16JAN96) via German Cosmonaut Thomas Reiter, DF4TR.
- 11) These are typical SAREX uplink frequencies. Refer to AMSAT News Service bulletins for exact SAREX frequencies.

AMSAT Journal Telemetry

AMSAT Election Results

Corporate Secretary Martha Saragovitz has announced the results of the annual election for the AMSAT-NA Board of Directors. A total of 1491 members cast ballots in this year's election and the results are as follows:

Bill Tynan	1246 *
Dick Daniels	1129 *
Junior de Castro	867 *
Bob Myers	746 *
Joe Holman	581 #
Robert Diersing	473
Steve Grant	374
Bruce Paige	357

* Elected to Board # Alternate Board Member

The four candidates receiving the highest number of votes were elected to serve on the Board for two years. The fifth highest vote-getter will serve as the alternate until the next election. The newly elected Board will meet at the site of the AMSAT-NA annual meeting in October. At that time they will elect AMSAT officers.

Financial Statement and Auditor's Report Available

The AMSAT-NA annual financial statement and auditor's report is available for member's review. If you would like to receive a copy send a self-addressed, stamped 10" x 13" envelope with \$1.24 postage to the AMSAT-NA headquarters address on page 3 of this issue.

Art Feller, KB4ZJ Honored

AMSAT-NA Treasurer Art Feller, KB4ZJ, has been honored by election as a Fellow of the Radio Club of America. The award will be presented at the club's 86th annual meeting, to be held in New York on November 17, 1995. The Radio Club of America, founded on January 2, 1909, is the world's oldest radio communications society. Its membership, past and present, includes many leading figures in amateur and commercial radio. Art has been a member of the club since 1976.

ARRL Technical Merit Award Goes to Dick Jansson

In July the ARRL Board of Directors conferred on Dick Jansson, WD4FAB, AMSAT Vice President for Engineering, the Technical Merit Award for his many years of work on amateur satellites, principally in the area of spacecraft mechanical and thermal design. This is the first time this award has been conferred since the 1970s. AMSAT congratulates Dick Jansson for this honor and thanks the ARRL Board for this action.

CQ CQ Deutsche

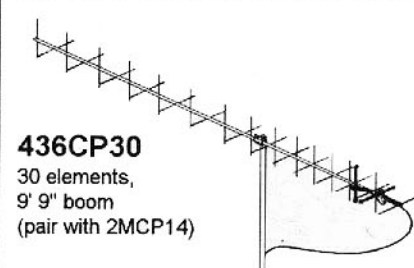
A general call is given for AMSAT members with experience in translating technical articles from German to English. From time-to-time, *The AMSAT Journal* would like to republish articles from *The AMSAT-DL Journal* that highlight various AMSAT-DL accomplishments and activities. Please contact Russ Tillman, (601-634-6398 or kc5jvb@amsat.org) if you are interested in providing this service.

M² YOUR SATELLITE ANTENNA SOURCE

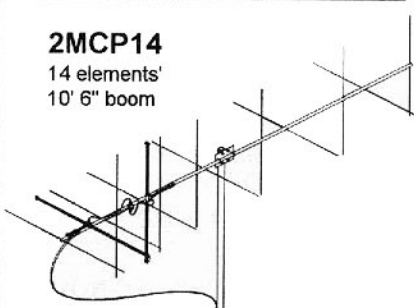


NEW! Ultra-gain!

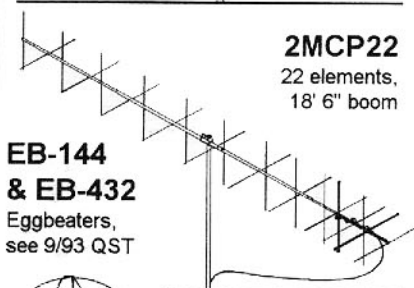
436CP42-U/G
42 elements,
18' 10" tapered boom
(pair with 2MCP22)



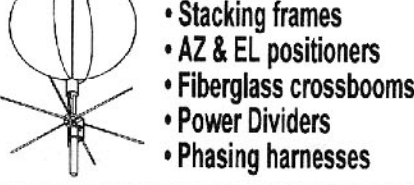
436CP30
30 elements,
9' 9" boom
(pair with 2MCP14)



2MCP14
14 elements'
10' 6" boom



2MCP22
22 elements,
18' 6" boom



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Yaesu G-5400B Az/El Rotor
Yaesu Az/El Rotor sep. kit

OSCAR Satellite Antennas:

M² 2MCP22 22 el. RHCP
M² 2MCP14 14 el. RHCP
M² 436CP30 30 el. RHCP
M² EB-144 Eggbeater
M² EB-432 Eggbeater
M² Ground plane for Eggbeater
KLM 2M-22C 22 el. and pol. switch
KLM 2M-14C 14 el. and pol. switch
KLM 435-18C 18 el. and pol. switch
KLM 435-40CX 40 el. and pol. switch

Crossbooms:

M² Fiberglass 10 foot by 2 inch
KLM Fiberglass 5 ft. X 1-1/2 in. dia.
KLM Fiberglass 7.5 ft. X 1-1/2 in. dia.

Rotor and Frequency Control:

SASI Sat Tracker plug and play
SASI Sat Tracker Doppler Tuner
AEA Satellite Tracker/Tuner ST-1

Modem for the Digital Satellites:

AEA DSP-2232 Multimode modem

Satellite Logging Program:

Electronic 2nd Op

Telemetry Decoding for AO-13 & P3D:

G3RUH 400 BPS Demodulator

Publications:

OSCAR Satellite Report
Satellite Operator Magazine
Have Fun Book
Satellite Experimenters Handbook
Getting Started on Satellites video
Getting Started on Packet video
Basic Packet Radio Book

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